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THE TREATMENT OF EXOPHTHALMIC GOITER (BASEDOW'S OR GRAVES' DISEASE), BY MEANS OF THE ROENTGEN RAYS[1]

BY GEORGE E. PFAHLER AND J. D. ZULICK, PHILADELPHIA, PA.

Etiology.—Many theories as to the exact cause of exophthalmic goiter have been advanced, yet none has been definitely or conclusively proven. Although all the symptoms point to disturbance in the nervous system, and while in some cases such a disturbance has been found at autopsy in the sympathetic and particularly in the lowest cervical ganglion, in other cases a thorough pathological investigation failed to reveal anything abnormal. Filehne [17] divided the restiform bodies in young rabbits and produced in them symptoms said to resemble those of exophthalmic goiter, but in autopsies performed on human beings who succumbed to this malady, these bodies showed no definite change. Perhaps the most generally accepted theory is the one first advanced by Moibus. According to this theory the symptoms common to Graves' Disease are due to the abnormal production of substances in the thyroid gland or result from the improper destruction of such substances by this gland.

In support of the first part of this theory are the results obtained in the investigations carried out in the Mayo Clinic by E. C. Kendall.[30] Lately Kendall has isolated from the thyroid a crystalline iodine compound which, in all probability, is the active constituent of the gland. Of course, Kendall's work is new and lacks confirmation by other investigators, yet, at the same time, his evidence is rather convincing. For instance, in fourteen days he gave in divided doses a total of 1/6 of a grain of this substance to a cretin weighing forty pounds, and increased the pulse rate of this cretin from 90 to 140. In another case he gave a woman weighing 112 pounds a total of ½ grain in eighteen days and raised her pulse rate from 75 to 130. He further reports that in an analysis of 137 thyroids from exophthalmic goiter cases, he found the iodine content low in the glands having a thin watery secretion, but as the secretion became thicker and less diffusible the percentage of iodine increased.

From his study of goiters removed from patients at the Mayo Clinic, Wilson [74] found that there was an increase either in the alveolar cells or in the alveoli, and that the severity of the symptoms by no means depended upon the size of the tumor. The size of the tumor depends upon colloid material which is a retention complement

[1] Read before the annual meeting at Atlantic City, 1915

change taking place in the retained secretions.

As to what factor or factors stimulate thyroid gland to this abnormal activity, there remains much doubt and uncertainty, but it has been known to follow shock, psychical disturbances and intoxications.

Thymic Hyperplasia in Exophthalmic Goiter.—There is strong evidence to show that there is an intimate relation existing between exophthalmic goiter and hypertrophy of the thymus gland. Nordmann [49] found that when the latter gland is hyperfunctioning it is liable to cause exophthalmic goiter or aggravate the symptoms of this disease. He operated on eighteen cases of exophthalmic goiter with three fatalities and in every one of the three who died (a man of 48 years and two women of 28 and 25 years) the thymus was found enlarged. His observations led him to believe that the cases of Basedow's disease of purely thymic origin are unable to stand the simplest operations on the thyroid under local or general anesthesia. The shock of the operation seemed to be the cause of death with persisting thymus in one of his cases who two years before had been successfully operated on for ruptured tubal pregnancy.

Klose [32] is another investigator who thinks that hyperplasia of the thymus is closely associated with exophthalmic goiter. In the literature which he reviewed he found some men who reported having found the thymus enlarged in as high as 90 per cent. of their cases.

Kocher's [33] percentage of thymus involvement in Basedow's disease is not as high as that reported by Klose, Kocher having found at operation and autopsy a tendency to tardy hyperplasia of the thymus in 50 per cent. of the cases.

Rautman [54] finds the thyroid always involved in exophthalmic goiter, the thymus usually so, and frequently changes in the other internal secretory organs.

Sinorzersky [62] made a study of twenty cases of exophthalmic goiter with the object of determining what influence the thymus gland had in its production. He treated with the roentgen rays some of his cases over the thymus gland after ligating two or three of the thyroid vessels, but most of his cases received this treatment before anything was done in the line of surgical procedure. The size of the thymus was determined by percussion, aneurysm being eliminated by fluoroscopic examination. He found by preliminary study on young dogs and rabbits that exposure to the roentgen rays caused an atrophy of the thymus and later that treatment of Basedow's disease by the roentgen rays directed toward the thymus gland caused amelioration of all the symptoms. He concludes, from his observation, that the rôle of the thymus gland in the pathogenesis of exophthalmic goiter is established beyond a doubt.

Walter [67] treated in the Johns Hopkins University Hospital sixty cases of exophthalmic goiter with the roentgen rays. The rays in each case were directed against the thymus gland through areas five centimeters in diameter in the first, second and third interspaces on either side of the sternum. Treatments were given in three series, six doses to each series, each dose amounting to 7½ H. Sixteen patients received the full three series, or 135 H, and of those cases 50 per cent. are apparently cured. Seven showed marked improvement and one failed to respond to treatment. Of nine patients who received two series, two were cured, five showed improvement, and one did not improve. Twenty-four patients have received one series of treatments, and some of these showed improvement. Two patients were operated after the third irradiation. The first signs of improvement are amelioration in the nervous symptoms and an improvement in the general health. Later there follows a slowing of the pulse rate and an improvement in the blood picture.

The Application of the Roentgen Rays to the Ovaries in Exophthalmic Goiter.—Mannaberg [41] has been using this method

during one and a half years. He treated ten cases in the General Polyclinic Hospital of Vienna under the direction of Keinböck. Seven of these were ambulatory cases and their habits were in no wise interfered with. Three others were treated for a time in the hospital. The results of this treatment were generally good but no case could be looked upon as cured. The patients were relieved of their subjective symptoms in all but two cases. These were only treated for a short time. All the others were able to return to their occupation. The eight in which treatment was continued over a considerable period showed a decided increase in weight, the pulse rate decreased at times markedly as much as from 144 to 88. At other times, only to a slight degree, but in no case did the pulse return to normal. In half of these cases there was no change in the exophthalmos. In the others there was more or less decrease and in one case the exophthalmos disappeared completely. Only the slightest influence upon the circumference of the neck was observed from exposure of the ovaries. The diarrhea disappeared almost miraculously. In several of these cases in which the menses were scant or had ceased they returned to normal. In one case the menses ceased at the end of a year, and after fifteen treatments. This patient was only twenty-five years of age and she complained of flashes of heat, but her Basedow symptoms had entirely disappeared.

He cannot explain the effects upon the exophthalmic goiter by exposure over the ovaries, but he believes the ovaries play a part in the symptoms of Basedow's disease. The treatments over the ovaries were usually given about once a month and continued from four months to a year. The author unfortunately does not give details of this technic or any idea of the quantity of exposure over the ovaries. In three cases, after treating the ovaries for several months, he made applications over the goiter. In two of these the symptoms were increased when he had expected a decrease. In one there was added improvement. He thinks both the goiter and the ovaries should be treated, and preferably the ovaries should be treated some time after the goiter treatment. Since reading this report we have made applications over the ovaries in one case which is being referred to as a failure by the treatment, but it is too soon to know whether satisfactory results will be obtained.

Theory of the Effects of Roentgentherapy.—It is a well-established fact that the highly specialized epithelial cells are the first to succumb to the action of the roentgen rays, and furthermore, the more closely these cells approach the embryonal type the more easily is their degeneration accomplished. Therefore, when the pathologic histogenesis of the thyroid and thymus glands in exophthalmic goiter is borne in mind it can readily be seen that in the roentgen rays we possess a therapeutic agent of undoubted efficacy in the treatment of this disease. That the rays are of great value is borne out by the large number of cases in Europe and America that have been successfully treated by men who are thoroughly familiar with the technic of roentgentherapy.

Ludin [40] collected 208 articles on this subject. The consensus of opinion of a vast majority of the authors of these articles was that the roentgen rays had a favorable influence on Basedow's disease. In general he found that the longer the duration of the symptoms the more treatment was required to cause their abatement and disappearance. He also found that there was little foundation in fact for the claim that the rays caused such changes in the capsule of the gland that made operation difficult.

Dr. Florence Stoney [66] published the results on forty-eight cases of exophthalmic goiter treated with the rays. She reports fourteen completely cured, twenty-two deriving great benefit and able to resume ordinary habits of life and return to work; four who derived no benefit; seven who quit treatment too soon to form any opinion

as to the efficacy of the treatment, and one in whom the pulse rate fell from 136 to 112 and who subsequently died twelve hours after operation. Her technic consisted in giving six milliampere minutes at a focal distance of 6 inches, treating each lobe separately. This amounted to less than a Sabauroud dose, the patients being treated twice a week for a month with a two weeks' interval before treatment was resumed. By her method a slight dermatitis at times results, and the length of time to effect a cure is from six to eight months.

Sklodow [63] reported a case which improved markedly after less than one month's treatment with the rays.

The case of Pfahler and Thrush [52] showed improvement after a month, and after she had received 22 treatments was apparently well.

Stegman [65b] reported three complete cures. He held no doubts as to the efficacy of the treatment, and suggested that the rays may act by producing a change in the gland epithelium which would change quantitatively and qualitatively the thyroid secretion.

Hirschl [24] reported as a result of his experience that under the influence of the rays the body weight was increased, the tachycardia lessened, mental condition improved, and that it did away with the alimentary glycosuria. In his cases the tremors, sweating and exophthalmos were not influenced.

Rudinger [57] advised a single tentative exposure of the thyroid gland to the rays: the results may justify a continuance of the treatment.

Faber [16] treated eight cases of exophthalmic goiter with the roentgen rays. In a few of the cases the results were very striking. One patient was a married woman who had symptoms for four years. She was given seven treatments, of ten minutes each, in the course of twelve days, and the same treatment repeated a month later. Four months after the second series of treatments she wrote that she was well.

Freund [19c] reports having obtained good results in five cases treated by the rays. In all of his cases there was a reduction in the size of the thyroid and coincident with this reduction in size, there was a diminution in the severity of the other symptoms, the previous symptoms subsiding, the heart beating more slowly and the patients increasing in weight. One of his patients, a young woman, had been sick six months before coming for treatment. She was under medical treatment for two months, but there was no improvement. She was given two treatments with an interval of one week between exposures. After this she improved rapidly, the goiter disappeared, and no tremor or recurrence could be detected. Freund thinks that the roentgen rays meet the indication for treatment by restoring normal conditions to a hypersecreting thyroid gland.

Miller [44] reports three cases, all of whom were cured by rays and an iodine free diet. In each of these cases thyroidectin had been unsuccessfully used.

In April, 1910, Schwarz [59e] of Vienna reported his results from the treatment of forty cases. Taking three months as the mean period of duration of treatment he found there was an increase of weight in 26, diminution of the pulse rate in 36, reduction of size of goiter in 8, amelioration of the exophthalmos in 15 and of the nervous symptoms in every case. In the light of the statement of Kraus that when the tachycardia has disappeared for a certain time one may consider Graves' disease as cured, although the other symptoms continued, Schwarz claims cures in 90 per cent. of his cases. Schwarz used rays filtered through 2 mm. of glass; gave ½ Sabauroud dose, treating the neck anteriorly, left and right laterally at intervals of a week.

In Oct., 1909, in a paper read before the Med. Soc. of Va., Gray [23] reported results from treatment in 12 cases of goiter, five of which were of the exophthalmic type. He found in every case without exception a diminution in size of gland. In those

presenting nervous symptoms there was a greater or lesser improvement. "In few if any of these cases," says the author, "has there been an apparent cure effected by *x*-ray treatment alone." In one of his cases operation was attempted, but had to be abandoned because patient was unable to stand the anesthetic. The patient was then given a course of *x*-ray treatment, and subsequently the operation was easily performed.

Holland [25c] reported in detail six cases (all females) treated by the rays. One of these patients (a woman of 25) had besides the marked exophthalmos, tachycardia (pulse 144) and an enlargement of the two lobes and thymus, visible throbbing, carotids, jaundice and vomiting. She had been on medical treatment, which included Leiter's tubes, potassium bromide, thyroidectin, iodides and iron for nearly three months, but was gradually getting worse and when *x*-ray treatment was begun, July 1, weighed 65½ pounds. Two weeks after treatment was begun improvement was noted, the vomiting being the first symptom to subside. From July 1, 1908, to Jan. 18, 1909, she had four series of treatments and during this time there was constant improvement excepting one relapse in September which passed off in a couple of weeks. In Feb., 1909, the patient was practically well, although there remained some exophthalmos and very slight finger tremors. In a discussion in 1908 Holland also spoke of results in general on 20 cases that had been treated in the infirmary and drew the following conclusions:

1. The pulse rate was nearly always reduced, and this almost at once.

2. The tremors and nervous symptoms improved from the start.

3. The gland noticeably diminished in size in some cases, remaining unaffected in others, but if hard, tense and throbbing, the throbbing diminished and the gland became softer.

4. The exophthalmos was not materially altered.

Hooten [27] reported 31 cases—fourteen private and seventeen hospital patients. His results show 80 per cent. cured and greatly relieved. Four of the hospital cases showed no improvement and one was operated upon with fatal result after five doses had been given.

It might be well to pause here to caution against the careless and unintelligent application of the rays in this and other afflictions where there is a definite indication for their administration. Many times failure to get results is not so much due to the rays as it is to the method of their application. Not a long time ago one of the writers on a visit to a hospital where operation for goiter is quite common, inquired of one of the surgeons whether they were treating any of their cases of the exophthalmic type with the rays. He replied that they used the rays in some of their cases about twice a week, but although he directed the treatment, he was unable to say just how much dosage this "twice-a-week" treatment represented.

In the collected papers of St. Mary's Hospital, 1905-1909, Rochester, Minn., appears this statement: "In certain cases the *x*-rays are applied over the gland for as many times as is sufficient to discolor or even burn the skin [This is a dangerous rule.—Pfahler and Zulick], and the treatment given until the general condition improves and the operation is safe. The improvement under the roentgen ray may be most marked for a time, but is seldom a lasting one."—Mayo.[43]

Results to Be Expected.—It is utterly impossible to draw conclusions from any collection of statistics on this subject because the cases reported show such a variation and such indefinite technic that the reduction of the statistics to percentages would give us nothing accurate by which we could judge future results. Technic has been reduced to a rational and scientific basis only within the past few years, and, therefore, one must draw conclusions as to the value of the treatment more from the individual opinions of competent observers

than by any mathematical calculations. We can agree with both Keinböck [31] and Nagleschmidt [46a] that no case of Basedow's disease should be operated upon until after there has been a trial of roentgen treatment. If the indications call for operation later, the patient will be in better condition for the operation after the treatment than before. Nagleschmidt [46a] says there can be no more doubt that the mortality from surgical interference is distinctly lessened by preliminary roentgen treatment. Nemenow [47] opposes the view that roentgen treatment preceding operation increased the difficulties due to fibrous tissue were found. In general, one may expect the following results, as judged by a review of the literature and from our own experience in the treatment of twenty patients:

Pulse Rate.—The pulse rate will show reduction in nearly all cases, and will serve as the best guide as to progress and as to the time of discontinuing treatment. We have seen a pulse rate reduced from 140 to 72. Schwarz [59a] found a decrease in pulse rate in 90 per cent. of his cases. As to the time of discontinuing treatment, the advice of Becléré [6] should be followed. He is guided by the pulse both as to its frequency and stability. The frequency is noted with the patient lying in the supine posture. The stability is noted by the amount of increase when the patient sits up suddenly. When there is little or no change in the frequency after this change in position, the treatment may be discontinued even though there is little or no change in the size of the goiter or the exophthalmos. In only one of the patients treated by us did we fail to get a reduction in pulse rate. This patient is still under treatment and the failure may be due to insufficient treatment.

Weight.—Next to the improvement in the pulse, one finds an increase in weight, for most of these patients have lost weight or are under-weight, and it is a delight to see them restored to a normal, healthy appearance. Schwarz [59a] found an increase in weight in two-thirds of his cases. In only two patients did we fail to get an increase in weight, and in fact, one patient showed a decrease in weight during the treatment. The explanation of failure in this recent case cannot yet be given.

Nervous Symptoms.—The sleeplessness, excitability, headache, the fits of uncontrollable temper and the tremors all show early improvement in the cases that respond to treatment, and these nervous symptoms improve nearly on a parallel with the pulse rate.

The Exophthalmos in Schwarz's [59a] cases showed an improvement in 50 per cent. We think less than half of our cases have shown improvement. We recognize that slight improvement in exophthalmos can easily be overlooked because of our difficulties in measurement, but in cases in which this symptom is marked one cannot expect its disappearance.

The Goiter.—Schwarz [59a] found a reduction in the goiter in only 20 per cent. of his cases. We find a reduction in about half of our cases, and while it is a late symptom to disappear, some improvement may be expected in the majority of cases. Fortunately, in the majority of cases it is not the goiter itself that gives rise to any alarming symptoms. It seems more likely that the symptoms are due to a hypersecretion or a disturbed secretion than to its size and this can be corrected in the majority of cases.

Technic.—The technic will vary with the individual case—the duration of the disease, the severity of the symptoms, the age, and the special circumstances surrounding the patient. As the literature shows in rare cases (reported by Kienböck [31] and Gilmer [20]), after the first treatment, the symptoms become more severe. This has been true in the treatment of one of our patients. On account of this, when the patient is living near, and especially in those cases of short duration, it is wise to give a small dose (⅓ to ½ of the full dose), and then wait two weeks before beginning active treatment.

Since the thymus is found to be enlarged in from 50 to 90 per cent. of the cases, and since some authorities believe that the hyperplasia of the thymus is a causal factor, we believe that it is wise to treat the thymic area in all cases, in addition to the treatment of the goiter.

The effect of the rays on enlarged thymus is most decided and quite prompt. Aubertin and Bordet [2] took new-born cats and rabbits and exposed the sternal regions to the rays with the result that there was an actual metaplasia of the thymus tissue into indifferent connective tissue. Eggers,[14] from his animal experiments, found that exposure of the thymus gland to the rays is followed first by an increase and then a decrease in the leucocytes, the cause of which they are not yet able to explain. From their experiments they could draw no conclusion as to the relation between the blood and the thymus gland. From the standpoint of the blood he concludes, however, that there need be no fear of injury from the roentgentherapy in the thymus hypertrophy. Regaud [55] and Cremiéu, by their experimental treatment of the thymus in young cats, found that there was necrobiosis and solution of the smaller cells. There was then great increase in the Hassall bodies. Later, these bodies disappeared with resorption of the central cells. If the treatment was not too intense, there was a regeneration within an interval of about thirty days, but with progressive raying, the thymus tissue was completely destroyed. These authors concluded that their experiments justified the application of the rays in the treatment of thymus enlargement in human beings. The results obtained in the treatment of human beings by Wiel and Gros,[70] Lange,[37] Morgan and Dachtler [45] in which the most pronounced symptoms were due to thymic hyperplasia and which were completely relieved by roentgentherapy, prove beyond a doubt the value of this treatment in enlarged thymus.

We believe that it is wise to make a roentgenogram in all cases. This will record any projection of the goiter into the thorax, any enlargement of the thymus, and any enlargement of the heart, and this record will be of value not only for the diagnosis of conditions at the beginning of treatment, but it will be of value for subsequent estimation of progress.

Division of Areas.—When the thymus is not found enlarged by roentgenogram, we believe that a single dose directed through the sternum will be sufficient. When it is enlarged, the rays should be passed through two fields, one on either side of the median line below the clavicles and including the first, second and third interspaces. When the goiter is not large and the Basedow symptoms are not marked, it will probably suffice to treat the thyroid through each side, making two doses crossfiring upon the interior of the gland. When the goiter is large and the symptoms rather marked, we sometimes divide the area about the goiter into from six to eight fields.

Dosage.—At no time should the treatment be carried to the extent of producing redness of the skin. Each dose should be carefully measured and filtered, and we believe at no time should more than 20-x or double tint "B" of the Sabouraud pastilles be exceeded in any particular area of skin. Unfortunately, the cases recorded in the past show that in many instances no attempt was made at measurement of dosage and the treatment, judged by the records made, must have been most inefficient. The absurdity of a surgeon trying to direct the treatment by saying the patient shall be treated three times a week for a certain number of minutes can only be appreciated by those familiar with the factors that make up the total dose. The quantity of rays will vary with the time of the exposure, milliamperage, the degree of vacuum of the tube, and the distance of the target from the patient. Generally speaking, with a Coolidge tube, transformer current, a parallel spark gap of nine inches and the target of the tube eight inches from the skin, 5 milliamperes of current given for 5 minutes

through 3 millimeters of aluminum and one layer of sole leather, will give 18 to 20-x or approximately double tint "B," and this is the dose we generally give.

Repetition.—This series of doses should not be repeated inside of three or four weeks, and we generally repeat once in four weeks. Sometimes it is advisable to divide the treatment so as to give a dose through only one or two fields at a time. After there is a distinct improvement in the symptoms, the interval should be prolonged, for there is danger of reducing the secretion of the gland so as to have the symptoms of hypothyroidism instead of hyperthyroidism.

General Treatment.—The general treatment which has been found to do good in these cases should not be ignored, and the most important of these is the avoidance of excitement, and increase in rest. Treatment directed toward the anemia should not be omitted.

Conclusions.—1st: We believe that the trial of treatment for one series with an interval of waiting of one month is justifiable in all cases, for if operation is decided upon nothing is lost, and many operations in this way can be avoided.

2nd: Treatment should be directed toward both the thyroid and the thymus glands.

3rd: An increase in weight and a decrease in pulse are the first signs of improvement and are practically always found.

4th: Treatment must not be prolonged over too great a period or hypothyroidism may be produced.

5th: The goiter and the exophthalmos are the last to show improvement, and in many cases show no change.

Bibliography of Roentgenology in Exophthalmic Goiter and Thymic Disease

1. Albers-Schönberg: Hamburg, Strumatherapie. Verhandle. d. Deutschen Röntgenges, 1906, Bd. II, S. 58. Diskussion.
2. Aubertin and Bordet: Über die Einwirkung der X-Strahlen auf die Thymus. Ref., Zentralblatt für innere Medizin, 1909, Nr. 40.
3. Bachen: Die Therapeutische Verwendbarkeit der Röntgenstrahlen. Ref., Fortschr. A. D. Gen. d. Röntgenstrahler, B. 14, Nr. 3, H. 3, P. 197, 1910.

4a. Beck, Carl, New York: Beitrag zur Diagnostik und Therapie der Struma. Fortschr. a. d. Geb. d. Röntgenstr., 1901, Bd. IV, Heft 3, S. 122.

4b. De la valeur des rayons X dans le traitement de la maladie de Basedow. Journ. de radiologie (Belge), 1908, Vol. II, Nr. 7, p. 58.

4c. Le goitre simple et le goitre exophtalmique. Journ. de radiologie, 1909, Vol. III, Nr. 5, p. 415.

4d. Bedentung der X Strahlen in der Behandlung des Morbus Basedowii. Ref., Lefebure: die Radiotherapie der Beharten teile des Gesichtes.

4e. Über die Kombination von Exzisions- und Röntgentherapie bei Morbus Basedowii. Ref., Berliner klin. Woch., 1905, Nr. 1.

5. Beck, Emil: Partial Thyroidectomy Combined with Roentgen Treatment in Basedow's Disease. Post-Graduate, 1908, 25.

6. Béclère: Diskussion zu Lyster, XVII, internationaler medizinischer Kongress, London, August, 1913, 22. Sektion, Radiologie.

7. Belot: Die Radiotherapie des Morbus Basedowii. Ref., Arch. d'Electr. Méd., Nr. 364, 1913.

8. Benedikt, Moritz: Wien, Röntgenbehandlung des Kropfes und des Morbus Basedowii, K. k. Gesellsch. der Ärzte in Wien, 26, XI, 1909. Ref., Berliner klin. Wochenschr., 1909, Nr. 51, S. 2331.

9. Bergonié et Spédier: Contribution à la radiothérapie, avril 1. Ref., Journ. de radiologie, 1910, Vol. IV, fasc. 20, p. 185.

10. Clarke: Bristol Med.-Chir. Journ., IX, 07. Ref., F. XII, 5, p. 367.

11. Cook, New York: The X-rays and High Frequency Treatment of Exophthalmic Goiter. (Kropf.) Ref., The Journ. of the Amer. Assoc., 1908, Vol. C, p. 758.

12. Decastello: Über akutes Auftreten von Basedowischen Erscheinungen nach Röntgenbestrahlung einer verber indifferentin Struma. Ref., Verhandlungen der Deutschen Röntgen-Gesellschaft, Band III, 1907.

13. De la Camp: Ärztl. Ver. Marburg, 21, II, '07. Ref., F. XI, 4, p. 290.

14. Eggers: Einwirkung der Röntgenstrahlen auf das Blut und den Thymus des Kaninscheua. Ref., Zeitschrift für Röntgenkunde und Radiumforschung, Bd. 15, H. 1, U. 2.

15a. v. Eiselsberg: Wien, Behandlung von Kröpfen mit Röntgenstrahlen. 81. Versamml. Deutscher Naturforscher u. Ärzte, Salzburg, 19, 25, IX, 1909. Ref., Wiener med. Wochenschr., 1909, Nr. 42, S. 2481.

15b. Zur Behandlung des Kropfes mit Röntgenstrahlen. Wiener klin. Wochenschr., 1909, Nr. 46. Ref., Fortschr. a. d. Geb. d. Röntgenstr., 1910, Bd. XV, Heft 6, S. 383.

16. Faber: Röntgenbehandlung von Struma, Morbus Basedowii und Neuralgien. Hospitalstidende, 1907, Nr. 34. Ref., L. B. d. Deutschen med. Wochenschr., 1907, Nr. 42, S. 1747.

17. Filehne: Text Book of Medicine, Vol. II, Strümpell.

18. Fiorentini und Linaschi: Ein seltener Fall eines mittels Roentgenstrahlen behandelten Kropfes. La Practica Oto-Rino Laringoiatrica, 1905, Nr. 5. Ref., Fortschr. a. d. Geb. d. Röntgenstr., Bd. X, Heft 2, S. 122.

19a. Freund: Wien, Röntgenbehandlung des Kropfes. Wiener med. Wochenschr., 1910, Nr. 21.

19b. The Roentgen Treatment of Goiter. Arch. of the Roentgen Ray, Nr. 119, May, 1910, p. 13.
19c. Münch. med. Woch., I, IV, No. 17.
20. Gilmer: München, Die Röntgenbehandlung bei Struma und Basedow. Kongress f. innere Medizin, München, 23, IV, 1906. Ref., Berliner klin. Wochenschr., 1906, Nr. 20, S. 653.
21. Golumbinin: Ein Fall von Therapeutischer Anwendung der Röntgenstrahlen bei Morbus Addisoni. Therapie d. Gegenwart, Mai, 1905. Ref., Fortschr. a. d. Geb. d. Röntgenstrahlen, Bd. IX, Heft 4, S. 303.
22. Görl: Nürnberg, Ein neues Feld für die Radiotherapie. (Strumenbehandlung.) Münchener med. Wochenschr., 1905, Nr. 20, S. 944.
23. Gray: Old Dominion. Jour. Med. and Surg., Vol. X, No. 2, Jan., 1910.
24. Hirschl: Wiener klinische Wochenschrift, XIX, No. 62. Progressive Medicine, June, 1908.
25a. Holland: The X-Ray Treatment of Exophthalmic Goiter. Arch. of the Roentgen Ray, 1908, Vol. XIII, Nr. 96, p. 39, and Liverpool Med. Chirurg. Journ., July, 1908.
25b. The X-Ray Treatment of Exophthalmic Goiter. Med. Presse, 28, X, 1908. Ref., Fortschr. a. d. Geb. d. Röntgenstr., Bd. XIV, Heft 2, S. 149, and the Royal Soc. of Med. Electro-Therap., Section 19, II, 1909. Ref., Arch. of the Roentgen Ray, 1909, Vol. XIII, Nr. 106, p. 343.
25c. Proceedings of the Royal Society of Medicine, Mar. 1, 1909.
26a. Holzknecht: Wien, Beitrag zur Symptomatologie des Morbus Basedowii, Zugleich eine Bermerkung zur Mitteilung von Prof. Frhr. v. Eiselsberg: Zur Behandlung des Kropfs mit Röntgenstrahlen. Wiener med. Wochenschr., 1909, Nr. 48, S. 2805 und 2807.
26b. Zur Röntgenbehandlung bei Strumen, insbesondere bei Morbus Basedowii, K. k. Gesellsch. der Ärzte in Wien. Ref., Fortschr. a. d. Geb. d. Röntgenstr., Bd. XV, Heft 1, S. 46.
26c. Bemerkung zu: Die Basedow-Debatte in der Wiener k. k. Gesellschaft der Ärzte von Dr. G. Schwarz, Wien. Ztschr. f. Röntgenkunde u. Radiumforschung, 1910, Bd. XII, Heft 8, S. 287.
27. Hooten: British Med. Jour., June, 1912. Abstract in Archives of the Roentgen Ray, Nov., 1912.
28. Iwanow: Über die Behandlung des Morbus Basedowii mit Röntgenstrahlen. Ref., Russki Wratsch., 1909, Nr. 25.
29. Jones: Royal Society of medic. Electrot. sect., 20, XII, '07. Ref., F. XII, 4, p. 286.
30. Kendall: The Isolation in Crystalline Form of the Compound Containing Iodine, Which Occurs in the Thyroid. J. A. M. A., June 19, 1915.
31. Kienböck: Über Reizwirkung bei Röntgenbehandlung von Struma und Basedowscher Krankheit. Ref., Fortsch. a. d. Geb. d. Roentgenstrahlen, Jan. 25, 1915, B. XXII, H. 5, p. 501.
32. Klose: Operations on the Thymus and the Effects on the Organisms. Therapeutische Monatshifte, Berlin, Jan., XXIX, No. 1.
33. Kocher: Exophthalmic Goiter and the Thymus. Archiv. für klinische Chirurgie, Berlin, Oct., C. V., No. 4.
34. Kohts, Robert: Zur Frage der Wirkung der Röntgenstrahlen auf den Morbus Basedowii. Inaug.-Diss., Marburg, 1908.
35. Krause, Paul: Breslau (Bonn), Röntgentherapie der Struma. Verhandl. d. Deutschen Röntgengesellschaft, Bd. 11, 1906, Diskussion.
36. Kuchendorf-Posen: Zwei Fälle von Basedowscher Krankheit durch Röntgenstrahlen sehr günstig beeinflusst. Deutsche med. Wochenschr., 1910, Nr. 21, S. 984.
37. Lange: American Quarterly of Roentgenology, April, 1911, Vol. III, No. 1, pp. 1-22.
38. Ledoux Lebard: Die Radiotherapie bei der Behandlung des Morbus Basedowii. Ref., Journal de Physiothérapie, Nr. 113, 1912.
39. Lepine: Radio-therapy and Basedow's Disease. Revue de méd., Jan., 1910.
40. Ludin: Roentgen Treatment for Goiter. Centralblatt f. d. Greuzgebiete d. Med. u. Chir., Jena, XVIII, No. 3.
41. Mannaberg: Über Versuche, die Basedowsche Krankheit mittels Röntgenbestrahlung der Ovarien zu beeinflussen. Ref., Wiener klin. Wochenschrift, 1913, Nr. 18, pp. 693-696.
42. Marie, Clunet et Ranlot: Radiothérapie du goitre exophtalmique. Société de neurologie de Paris, 1, VI, 1911. Ref., Journ. de radiologie (Belge), 1911, Vol. V, fasc. 4, p. 401.
43. Mayo: Goiter: Its Surgical Treatment Based on 475 Cases.
44. Miller: Lancet Clinic, Cincinnati, May 25, 1907.
45. Morgan and Dachtler: Thymic Asthma Successfully Treated by X-Rays. Surgery, Gynecology and Obstetrics, December, 1914.
46a. Nagelschmidt: Röntgenbehandlung von Struma und Basedow. Röntgentaschenbuch, Band V, 1913, Seite 140.
46b. Berl. med. Ges., 4, XI, '08. Ref., F. XIII, 3, p. 172.
47. Nemenow: Zur Frage der Behandlung des Morbus Basedowii mit Röntgenstrahlen. Ref., Russki Wratsch., 1912, Nr. 38.
48. Newman: Lancet, 27, XI, 1909, Vol. II, p. 1584.
49. Nordmann: Experimental and Clinical Study of the Thymus Gland. Archiv. für klinische Chirurgie, Berlin, CVI, No. 1.
50. Pereschiwkin: Röntgenbehandlung bei Morbus Basedowii. Russki Wratsch., 1911, Nr. 35. Ref., Deutsche med. Wochenschr., 1911, Nr. 44, S. 2052.
51. Pfahler, Philadelphia: A Summary of the Results Obtained by the X-Ray Treatment of Exophthalmic Goiter. New York Med. Jour., Oct. 24, 1908.
52. Pfahler and Thrush: Exophthalmic Goiter Treated by the Roentgen Rays. Therapeutic Gazette, 15, III, 1906.
53. Price: Treatment of Exophthalmic Goiter by the X-Rays. The Therapeutic Gazette, Dec., 1908.
54. Rautman: The Pathologic Anatomy of Exophthalmic Goiter. Mittheilungen a. d. Greuzget der Med. und Chir., Jena, XXVIII, No. 3.
55. Regaud and Crémieu: Die Involution der Thymus unter dem Einfluss de Röntgenstrahlen. Ref., Journal de Physiothérapié, Nr. 109, 1912.
57. Rudinger: Deut. med. Woch., XXXIII, No. 2. Progressive Medicine, June, 1908.
58. Schlesinger: 1906, Wien kl. Rundschau, 06, 17.
59a. Schwarz: Die Röntgentherapie der Basedowschen Krankheit. Ref., Wiener klinische Wochenschrift, 1908, Nr. 35.
59b. Neurol, Central-Bl., XXV, '06, 16 Cf. Verein f. Psych. u. Neur. Wien, 13, II, '06.

59c. Wien, Die Röntgentherapie des Morbus Basedowii. Gesellsch. f. innere Medizin u Kinderheilkunde, Wien, 9, VII, 1908. Ref., Wiener med. Wochenschr., 1908, Nr. 35, S. 1942.
59d. Die Basedow-Debatte in der Wiener K. k. Gesellschaft der Ärzte. Ztschr. f. Röntgenkunde u. Radiumforschung, Bd. XII, Heft 3, S. 98, und Heft 10, S. 351.
59e. Die Radiotherapie des Morbus Basedowii. Arch. d'électr. Méd., Nr. 282. Ref., Fortschr. a. d. Geb. d. Röntgenstr., Bd. XV, Heft 5, S. 313.
59f. Röntgenbehandlung des Kropfes. Wiener klin. Wochenschr., 1909, Nr. 47. Ref., Deutsche med. Wochenschr., 1909, Nr. 49, S. 2186, und Fortschr. a. d. Geb. d. Röntgenstr., 1910, Bd. XV, Heft 6, S 283.
59g. La Radiothérapie de la maladie de Basedow, III, Congrés intern. physiothérapié, 30, III, 1910. Ref., Journ. de Radiologie, 1910, Vol. IV, fasc. 20, p. 153, et Arch. of the Roentgen Ray, 1910, Nr. 120, p. 69.
60. Settmacher: Therapeutische Wirkung der Röntgenstrahlen. Ref., Wissenschaftl. Verein der Militärärzte der Garnison Wien, Sitz 5, 3, 10.
61. Simon, Alexander: Wiesbaden, Über Röntgenbestrahlungen der Schilddrüse bei Thyreoidismus. Deutsche med. Wochenschr., 1911, Nr. 29, S. 1345.
62. Sinorzersky: Roentgen Exposures of the Thymus in Treatment of Exophthalmic Goiter. Russky Vrach., Petrograd, June 27, XIII, No. 24.
63. Sklodow: Deutsche med. Woch., XXXII, No. 33. Progressive Medicine, June, 1908.
64. Sklodowski: D. m. W., XXXI, 33, 1906. 1, Subj. guter Erfolg, Gewichtszunahme, 13, 3 kg in 16 Wochen.
65a. Stegmann, R.: Wien, Die Behandlung des Kropfes mit Röntgenstrahlen. K. k. Gesellschaft der Ärzte in Wien, 23, VI, 1905. Ref., Fortschr. a. d. Geb. d. Röntgenstr., Bd. IX, Heft 2, S. 144, und Wiener med. Wochenschr., 1905, Nr. 27, S. 1400.
65b. Die Behandlung der Struma mit Röntgenstrahlen, Münchener med. Wochenschr., 1905, Nr. 26, S. 1247. Wiener klin. Wochenschr., 1906, Nr. 3, S. 62 und Nr. 16.
66. Stoney: On Results of Treating Exophthalmic Goiter with X-Rays. Arch. R. R., Jan., 1913, p. 320.
67. Walter: Roentgenization of the Thymus Gland in Graves' Disease, J. A. M. A., April 24, 1915.
68. Warrington: A Discussion on the Pathology and Treatment of Exophthalmic (Basedow), Liverpool Med. Institution, 12, III, 1908. Ref., The Lancet, 1908, Vol. I, p. 859.
69. Weil: Drei neue Fälle von Thymushypertrophie, die durch Radiotherapie geheilt werden kounten. Ref., Journal de Physiothérapie, December, 1912.
70. Weil und Gros: Thymushypertrophie und Radiotherapie. Ref., Bull. et Mémoir. de la société de Radiol., July, 1912.
71. Wetterer: 1908 Handb., p. 709.
72. Widermann: Basedowscher Krankheit. Ref., Gesellschaft f. innere Medizin und Kinderheilkunde in Wien, December 21, 1905.
73. Wiesner, Bernhard: Aschaffenburg, Röntgentherapie bei Morbus Addisonii. J. Wetterer, Handbuch der Röntgentherapie, 1908, S. 717.
74. Wilson: American Journal of Med. Sciences, December, 1908.
75. Wohrizek: Zur Röntgenbehandlung von Strumen. Ref., Prager med. Wochenschrift, 1909, Nr. 51.
76. Zimmern u. Raymond: 1905. Soc. de Therap., 10, V, '05. Ref., M. m. W., '05, p. 1269.

RECENT RESULTS IN THE X-RAY TREATMENT OF MENORRHAGIA, DYSMENORRHEA, AND UTERINE MYOMA

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THE *x*-ray treatment of menorrhagia and uterine fibroids by the production of the artificial menopause has been given a new impetus by the invention of the Coolidge tube. While the results obtained by the use of the older type of tube were in a measure satisfactory, yet they were difficult and tedious to elicit and failures were common. If the proper technic is employed, the effect of Coolidge tube radiation upon the ovaries is the most certain of medical phenomena. If sufficient radiation be absorbed by the ovaries they will cease to functicnate in their fullest physiologic aspect and a cessation of menstruation will result. This is a rule to which we have found no exception. In properly selected cases this method becomes therefore the safest and surest as well as perhaps one of the most valuable of therapeutic measures. While Albers-Schonberg and some of the early workers in this field placed the age limit at 39 years, below which it was impracticable to bring about the menopause by *x*-ray therapy, the proper Coolidge tube technic removes all age limits. We have recently produced what seems to be a permanent menopause in two girls of seventeen years and one of nineteen years. In the case of one of the seventeen-year-old patients twelve

months have passed since the treatment has been completed and there has been no return of the menstrual flow. It, therefore, seems not too radical to assert that the menopause can be produced by *x*-ray therapy in any menstruating female, whether she be thirteen years or fifty years of age. Although we appreciate the unwisdom and perhaps impropriety of promising results, we have been impelled to promise the desired results to patients who present themselves for this line of treatment providing always that the case is properly selected, that is, providing that malignancy has been excluded as far as is possible and that there is no inflammatory pelvic condition (such as pus-tubes) present which demands surgery.

The difficulty of selecting cases and excluding the possibility of malignancy is the only just criticism that can be directed against this method of therapy. We should acknowledge the soundness of this criticism but from the practical standpoint the method is not invalidated to any great degree by it. In the younger patients the possibility of the presence of malignancy decreases with the age of the patient. In the older patients the preliminary examination should be more rigorous. The careful selection of cases suited for *x*-ray therapy is greatly facilitated by the fact that most cases are chronic or of some duration before they are referred for *x*-ray therapy. Furthermore, in a large percentage of cases curettement will have been previously resorted to, either as a therapeutic or a diagnostic procedure or both. Therefore, in most cases the fullest opportunity is presented for the recognition of malignancy before *x*-ray therapy is considered. The fact that the results in properly selected cases are manifested so soon after the beginning of the treatments also helps to exclude malignancy, as no case will exhibit a prompt response to *x*-ray therapy if there is an underlying malignancy present. If there be an inflammatory involvement of the pelvic organs present, as a complication or as a cause of the symptoms, the administration of *x*-radiations to the ovaries will do no harm, but will tend to relieve the symptoms by depressing the ovarian function. The presence of such inflammatory pelvic complication is the most common cause of failure of the *x*-ray to bring about the desired results and is the most common cause of recurrence of the symptoms following a supposed cure. If the condition subjected to *x*-ray therapy be fibroids, the possibility of malignant changes developing later in the myoma tissue which has been shriveled and degenerated by the *x*-ray must be considered. The possibility of such malignant changes is a rather remote one and is not a weighty objection to the method. A review of the literature fails to reveal any recorded cases of malignancy developing in the remnants of fibroids which have been previously subjected to *x*-ray therapy.

The fact that the abatement of the ovarian function by *x*-ray therapy is a gradual one and the fact that under the older technic there frequently occurred after a lapse of six months or a year a reëstablishment of ovulation and menstruation, brings up the question of the possible fertilization of an ovum extruded from an ovary which has suffered *x*-ray impingement. There is abundant experimental evidence to suggest the possibility of the birth of a deformed or degenerated offspring under such condition. In answer to this it may be said that such an untoward effect has never been recorded or observed. If conception should occur under such circumstances it would in all probability terminate in abortion.

The present paper is based upon fifty consecutive cases of menorrhagia, dysmenorrhea and uterine fibroids treated by *x*-ray therapy. In every case a satisfactory result was achieved, an artificial menopause, apparently permanent, occurring in every case in which it was desired regardless of the age of the patient. These cases were referred from many different sources, and while only ordinary care and skill were employed in their selection, malignancy has not developed in any case either during or following the treatment. So far as I have been able to fol-

low the cases there has been no recurrence of the menstruation after it has once stopped. In several cases there has been an occasionally faint show during the few months just following the menopause. After a lapse of a few months, however, abatement of the ovarian function has been complete and permanent.

We have found it to be a safe working rule that if one period is missed all treatment may be discontinued, as it is almost certain that, even though there may be an occasional showing, a permanent cessation of menstruation will finally result. Since it is usually impossible to foretell just how much treatment the patients of various ages will require we keep the patients under treatment until one menstrual period is missed. In patients past forty years one treatment (100 X) often suffices, four being the maximum. Occasionally a patient has stopped treatment before any results were manifested, yet after a lapse of a month or two the menopause has developed. In one case of menorrhagia, the patient became discouraged because the symptoms were not ameliorated by one month of treatment and refused to continue with them. We felt that she had been underdosed, yet after a lapse of two months a permanent menopause developed. It would seem, therefore, that it is possible by the proper technic to bring about the menopause in a short period of time (two or four weeks) by pushing the treatment or a smaller amount of *x*-radiation may be given and the results awaited after a lapse of several months. The urgency of the symptoms may thus determine the rapidity with which the ovarian changes are to be brought about.

The practical application of this method of treatment is ever widening, and its clinical value is correspondingly enhancing. Two cases now under *x*-ray treatment exemplify the diversity of its clinical application. One case is that of a married woman age forty-four, who is now experiencing the natural menopause. But the nervous symptoms incident to this change are so stormy that the patient is quite unbalanced. She has mental aberrations, severe headaches, inability to sleep and a variety of other nervous symptoms rendering her condition pitiable. The *x*-ray treatments are being given to shorten the transition period and hasten the establishment of the menopause. The second case of interest in this connection is a young girl of eighteen who suffers with severe epileptic seizures at each menstrual period. In the intervals she is entirely free from attacks. She is also mentally inferior and has been placed in one of our institutions for the care of epileptics. *X*-ray treatments are being given in this case to bring on an artificial menopause, thus removing the exciting cause of this seizure. The accompanying sterilization will prevent her from reproducing her kind.

The technic employed in this series of cases is a very simple one. Only four portals of entry were used, two anteriorly and two posteriorly. Each area was made rather large (about three inches square) so that the divergence of the rays would be sufficient to strike both ovaries at each dose, no matter what the position of the ovaries might be. Such large areas obviate the possibility of missing the ovaries which is always to be feared when extremely small portals of entry are used. The fact that *both* ovaries are always reached by each exposure compensates in a measure for larger surface dosage in the multiple small area method. This method of using only a few portals of entry is best suited to the comfort of the patients as the time occupied by each treatment is lessened and the post-irradiation toxemia is minimized. These are important factors in the handling of the type of patients that usually present themselves for this treatment.

A Coolidge tube backing up a parallel spark of nine to nine and one-half inches was employed. A filter of three millimeters of aluminum and a piece of thick sole leather was used.

In the first twenty cases of this series a target-skin distance of eight to nine inches

was employed and forty to forty-five milliampere minutes was administered to each of the four skin areas at each treatment. Eight to nine milliamperes were passed through the tube for five minutes over each area. The dose thus delivered varied from 15 X to 25 X. During each treatment, therefore, each ovary received 160 to 180 milliampere minutes, or 60 X to 100 X, as measured at the skin. In the treatment of the second twenty cases of the series the target-skin distance was reduced to six inches and the Coolidge tube container was pressed firmly against the abdomen so as to decrease the distance between the skin and the ovaries. At six inches distance over 20 X were given through each area, or about 100 X at each treatment. In order to economize time we are now passing ten milliamperes through the tube for two and one-half minutes at each dose. Each treatment by this method requires only ten minutes of actual raying. Within a month the patient would receive three such treatments.

When using the earlier technic, that of forty milliampere minutes and eight- to nine-inch target-skin distance, it was necessary to keep the target-skin distance well above eight inches and to allow two weeks instead of one to elapse after two successive treatments were given in order to avoid burns. With the later technic, however, no burns have developed. The pubic hair is carefully protected and has not been lost in any case. The alkaline lotion as suggested by Dodd has been prescribed as a prophylactic measure at the beginning of the treatments and its daily use has been insisted upon during the entire course of *x*-ray treatments whether the skin showed any irritation or not.

In this series of fifty cases, nineteen were treated because of persistent menorrhagia. The ages of the patients varied from seventeen years to fifty years. The minimum of *x*-radiation required to bring about a permanent menopause was one treatment (100 X) in a woman of forty-nine. The greatest amount given any patient was 800 X (eight treatments) which was required to abolish the ovarian function in a girl of twenty. Another patient of seventeen years of age required only 700 X to accomplish the same result. A woman of twenty-eight required 600 X (six treatments). A woman of thirty-two required 500 X. With increase in the age of the patients the amount of *x*-radiation required to abolish the menstrual flow rapidly decreases. Thus patients around forty years required 500 X (five treatments), while between forty-five and fifty years 100 X to 400 X (one to four treatments) usually sufficed. The dosage in all of these cases was undoubtedly in excess of what is actually required, as the treatments were continued until a menstrual period was missed, and in some instances even longer, whereas experience has shown that in cases where *x*-ray treatment was suspended before any diminution of the hemorrhage or menstrual function was evident, the desired results have developed in one or two months after the suspension of the treatment.

Brief outlines of some of the more interesting cases will be given.

Case I.—The youngest patient of this group. Miss B. (referred by Dr. Thomas Hulick), age seventeen, began to menstruate at fourteen. The periods were always irregular, however, and the flow very profuse. The menstrual flow gradually became quite excessive, necessitating a curettement, which was done in January, 1914, by Dr. Hulick. Continuation of the symptoms demanded another curettement in October, 1914, which was followed by relief for six months.

The present trouble began March 17, 1915, with continual hemorrhage from the uterus which persisted more or less constantly until June 7, 1915, when the patient was referred for *x*-ray treatment. Pelvic examination as made by Dr. Hulick was negative. The abnormal bleeding stopped after the third treatment (300 X having been administered), and the menstrual periods were abolished after the seventh (700 X).

Case II.—Miss A., age twenty (referred by Dr. E. M. Craig), first menstruated at fifteen. She had always been irregular, however. The menstrual periods extended over five to seven days and upon exertion would be prolonged. About two years ago the menstrual periods became very frequent and profuse, occurring usually every two weeks. Some periods lasted as long as thirty days. For this condition she was curetted in August, 1914, by Dr. Craig. She did not have a return of the menstrual periods for thirty-five days after curettement; then the intervals decreased to twenty-five days and then twenty-one days. The flow was excessive, lasting ten to thirteen days. In January, 1915, was confined to bed for two weeks owing to the excessive hemorrhage, which lasted thirty days. She began *x*-ray treatment February 19. Four treatments (400 X) caused a cessation of the excessive hemorrhage, and eight (800 X) caused a disappearance of the menstrual flow. The patient experienced the hot flushes characteristic of the climacteric.

Case III.—Mrs. P., aged twenty-eight, began to menstruate at fourteen and was always regular. The flow was not excessive. She was married at twenty and has one child five years old. She has had two miscarriages, but always regular up to three years ago, when excessive menstruation began. After each period the bleeding continued throughout the month and was controlled only by curettement. She was curetted five times in two years. The bleeding gradually became more severe and she was curetted last on September 19, 1914, and remained well about six weeks. The bleeding then returned and has been almost constant until December 17, when she was referred for *x*-ray treatments by Drs. E. M. Craig and Ambrose Johnston.

At the time she presented herself for treatment, she was extremely anemic. She had lost considerable weight and the skin and mucous membranes were almost white. She was so weak that it was with difficulty that she was brought to my office for treatment. Pelvic examination as made by Drs. Craig and Johnston was negative. She was given four *x*-ray treatments (400 X) from December 17 to January 9, with very little change in the condition. Bleeding became more severe after the fourth treatment, and she was confined to bed as a result. She suffered also with an attack of influenza at this time, which delayed the treatments one month. The next treatment was given February 19, and another February 27. Shortly before the treatment of February 19 she noticed a decided improvement. The flow then stopped entirely and has not returned. Her next period was due March 4, but failed to appear. Likewise, her April period failed to appear. From February, 1915, to the present date, there has been no return of the hemorrhage and no sign of the menstrual flow. She has gained greatly in weight and strength, and is now able to attend to her household duties. She now experiences the hot flushing characteristic of the menopause. She has received a total of eight treatments (800 X). The bleeding and menstruation stopped after the sixth treatment.

Case IV.—The case of Mrs. R., wife of a physician, is of more than passing interest, since it illustrated an important point in the history of this class of cases.

She was thirty-two years of age, had been married about seven years, but had never been pregnant. During the last two years she has had excessive menstrual flows and profuse hemorrhages in the intervals. For some time before beginning the *x*-ray treatments she had been bleeding almost constantly. Pelvic examination was negative. During the time covered by these treatments, the bleeding seemed to be increased and her condition became so bad that it seemed for a time that the *x*-ray treatments would have to be abandoned, especially since she lived more than one hundred miles from Cincinnati, and the trips were very difficult for her. After the fifth treatment, however, she began to improve, and after the sixth treatment the hemorrhage and the men-

strual flow stopped and have not returned to date.

Many of our patients experienced a similar increase of the bleeding during the time occupied by the first few treatments. Then the flow would often stop abruptly and would not return.

Case V.—The case of Miss T., an unmarried girl of twenty-five, is of especial interest, as the menopause was not desired but the *x*-ray treatments were undertaken simply to inhibit the ovarian activity. The patient first menstruated at twelve, but menstrual periods have always been irregular, usually appearing from a few days to a week ahead of time. The menstrual flow has been extremely free and usually excessive. At about seventeen the flow became so excessive and so frequent that the patient was curetted and a retroversion corrected.

Following this operation for one year the periods were regular and the flow was normal in amount. Since one year after the operation, the patient has had a second period in the middle of each month lasting about a week, but the flow is not so profuse as at the regular period. For this second period in the middle of each month and because of the excessive flow at each regular period, the patient was referred for *x*-ray treatments by Dr. Elizabeth Campbell.

She began *x*-ray treatment a day before the usual time of the appearance of the intermenstrual period, which then failed to appear. The next regular menstruation was about as usual, but the second intermenstrual period failed to appear, and only a scant discharge was manifest. From this time and continuing three months, the periods were regular and normal, but the menopause later developed. She was given 600 X in all.

It seems entirely practical, however, to undertake to inhibit ovarian activity in such young patients without producing a menopause. In several of our early cases in which only an inhibition was desired a complete menopause has resulted. But these cases were treated before our technic was standardized. Now we feel perfectly safe in undertaking to inhibit but not abolish the ovarian activity. The maximum dose which may be administered without producing the menopause varies with the age of the patient, but can be predetermined with a fair degree of accuracy by referring to the previously given scale of dosage.

The following case in which the menorrhagia in a young girl was corrected by a single treatment (100 X) illustrates this point.

Case VII.—Miss O. (referred by Dr. Nora Crotty), aged 19, single, has suffered with menorrhagia for one and one-half years. The menstrual flow has been very profuse at the periods and there have been irregular bleedings in the intervals. Local examination is negative.

This patient was given one treatment (100 X), which restored the menstrual function to its normal state. The intermenstrual flow ceased and the menstrual flow at the regular periods has been normal in quantity.

Case XI.—Miss C. (referred by Dr. George Sikes), single, age forty, began to menstruate at sixteen. The periods have always been rather scant and painful. The present trouble commenced four years ago with very profuse periods. The bleeding would continue for ten days, making the patient very anemic and weak. The flooding has been gradually getting worse up to the time the patient was referred for *x*-ray treatment. Pelvic examination was negative. The hemorrhages are so profuse that patient is confined to bed at these times and is compelled to remain in bed after periods in order to regain her strength. The administration of 400 X caused a complete abolition of the menstrual function.

Case XIV.—Mrs. R. (referred by Dr. M. Higgins), age 43, began to menstruate at fourteen and was always regular up to the age of eighteen, the date of her marriage. She has three children and has had three miscarriages. She has always been regular, but the periods have always lasted from seven to eight days, and were always quite

profuse. The present trouble dates back eight years, since which time the menstrual periods have lasted from twelve to fourteen days and during the latter part of these periods she has profuse hemorrhages. She has become very weak and has lost considerable weight. Pelvic examination is negative. She was given 500 X over a period of six weeks. During this time she has two very severe periods and became so discouraged that she stopped treatment, believing that the treatments were making her worse. Two months later Dr. Higgins notified me that the menstrual flow had failed to appear. Her menopause dates from this time.

The history of this case shows that the *x*-ray treatments need not be continued until an improvement of symptoms is manifest, unless the symptoms be urgent. After a sufficient dose (determined by the age of the patient) has been given, the treatment may be stopped irrespective of the symptoms and the results confidently awaited. We will thus spare the patients much unnecessary irradiation and save ourselves much time.

Case XV.—Mrs. W., aged forty-seven, began to menstruate at thirteen years, but has never been very regular. Her periods have usually come on at intervals of three weeks or less. She married at twenty-three and has had five children, two of them premature births. Since the first childbirth, she has suffered with prolapse of the uterus. Since the first child was born, twenty-four years ago, the patient has been menstruating twice each month.

Present trouble began nine weeks before she was referred for *x*-ray treatment, when bleeding became constant. It continued without intermission and became so severe that the patient consulted Dr. J. P. Beneke. At the time of beginning treatments, the patient had been bleeding for three weeks. She was very anemic and weak. Bleeding stopped after first exposure, March, 1915, and has not returned. She has had no period up to the present date, and there has been no return of bleeding or menstrual flow. This case required but one treatment (100 X).

Case XVI.—Mrs. W., age forty-eight (referred by Dr. E. W. Mitchell), has always menstruated regularly. She married at thirty-four years. Since this time menstruations have always been very profuse, lasting at least a week and sometimes more. She has never been pregnant.

The present trouble began three years ago with profuse menstruation accompanied by nausea and other nervous symptoms. At intervals she has profuse periods, some of them lasting more than two weeks. These periods have become worse, and previous to beginning the *x*-ray treatment she has had a continuous flow for seven weeks. This prolonged period began April 17, 1915, and continued until June 5, 1915, one day after the first *x*-ray treatment was given. The bleeding stopped after the administration of 100 X, and there has been no recurrence of the bleeding. She has subsequently received 200 X, however. This case likewise required but one treatment (100 X).

Case XVII.—Mrs. B., aged forty-eight (referred by Dr. Henry W. Bettman), was married at twenty-three years, and has two children. The present trouble began two years ago with profuse periods, lasting eight to nine days, causing her to become weak and anemic. Examination of pelvis was negative. A menopause was established after the administration of 300 X (three treatments).

Case XVIII.—Mrs. R., aged fifty (referred by Dr. H. F. Gau), began to menstruate at eleven and always menstruated profusely. She married at twenty-three and has nine children. Present trouble began last February, 1915, with profuse menstruation, causing her to become weak and anemic. She consulted Dr. C. L. Bonifield in April, 1915, who examined her but found no abnormality in the pelvis. He suggested a curettement. Three hundred X brought about a menopause.

Twenty-four cases of this series of fifty were treated for uterine fibroids. A satis-

factory result was achieved in each case. While in most of the cases the treatment was undertaken to control the excessive bleeding, yet in some there was no bleeding and the *x*-ray treatments were given solely to reduce the size of the fibroids and relieve the pressure symptoms. While it was formerly believed that the fibroids were influenced only secondarily through inhibition of the ovarian function, it is now conceded that the *x*-ray has a direct action upon the fibroid, producing an actual shrinkage. While it was formerly observed that many months, or perhaps a year or more, were required for an appreciable shrinkage of the fibroid, in a number of cases in this series the shrinkage equaled 30 per cent. to 50 per cent. in six to eight weeks. In one case a 50 per cent. reduction occurred in four weeks. The pedunculated submucus types of fibroids are the only ones which are unsuited to this treatment. In two of the cases of this series there were neither bleeding nor pressure symptoms. The *x*-ray treatment was undertaken to produce a menopause and shrinkage of the tumor purely as a prophylactic measure against possible complication in the future. In two cases the patients had experienced the menopause but were suffering from pressure effects of the tumor. The ages of the patients varied from twenty-six years to sixty-five years.

Case XXVII.—Mrs. M., aged twenty-six (referred by Dr. Ambrose Johnston), married at seventeen and has four children. Present trouble began six months ago with scant menstruation and excessive pain at the periods. Pelvic examination by Dr. Johnston shows small fibroids scattered through the uterus. *X*-ray treatment was recommended to allay menstrual pain, inhibit the growths of the fibroids and avoid future complications. The administration of 600 X produced the menopause.

Case XXIX.—Miss G., aged thirty-two (referred by Dr. M. Dreyfoos), single, first menstruated at thirteen years. The menstruations have always been regular and not painful. In the last three months she has experienced a marked pressing in the pelvis, for which she consulted Dr. Dreyfoos. He found a large fibroid in the post-wall of the uterus and recommended *x*-ray treatment. Periods have been regular and normal. She has no intermenstrual bleeding. Six treatments (600 X) caused a permanent cessation of the menses. Vaginal examination was made by Dr. Dreyfoos, three months after the completion of the treatment, and revealed a marked reduction in the size of the fibroid.

Case XXXII.—Mrs. B. (referred by Dr. H. L. Burdsall), aged 35, first menstruated at fourteen and was always regular. She married at eighteen and has two children. Present trouble began February 25, 1915, with excessive and continued menstruation lasting two months, accompanied by considerable pain in the pelvis. She consulted Dr. Burdsall, who found a deep mass in the pelvis. This mass was as large as an orange and was to be felt to the right of the uterus and apparently connected with it. Owing to adhesions present, Dr. Burdsall could not determine its exact nature, but from the fact that there was no fever and not much pain, there was little doubt that the mass was a fibroid. *X*-ray treatments began June 7, 1915, and 500 X was administered. A menopause was established and a pelvic examination by Dr. Burdsall on August 5, 1915, revealed the tumor to be not more than 25 per cent. of its original size. This remarkable shrinkage verified the diagnosis of fibroid.

Case XXXIII.—Mrs. R., aged thirty-six (referred by Dr. M. Flenner), began to menstruate at twelve years. She married at twenty-three and has three children. Menstruations have always been scanty but regular. Present trouble began one and a half years ago with irregular periods and nausea lasting four months. The periods were sometimes six weeks apart and again two weeks apart. The bleeding has gotten progressively worse. Within the last two or three weeks it has been almost constant, with only periods of four or five days be-

tween bleedings. A pelvic examination by Dr. Flenner revealed a small fibroid the size of a peach. Seven treatments (700 X) brought about the artificial menopause.

Case XXXIV.—The following history is fairly typical of the progress of the average case under *x*-ray treatment: Miss M. C. (referred by Dr. E. M. Keefe), a school teacher, aged forty, single, had always menstruated regularly, the flow being moderated and lasting five days. About November 1, 1914, she had a profuse menstrual period lasting ten days. After a brief remittance, the bleeding again recurred. The loss of blood was so great that the patient was prostrated and clear vision was lost. After two weeks in bed she was removed to a hospital, where a curettement was done by Dr. Keefe. Pelvic examination as made by Dr. Keefe revealed multiple small fibroids scattered through the uterine walls.

On January 8, 1915, the patient was referred for *x*-ray treatment by Dr. Keefe. From January 8, 1915, to January 22, there was no flow. On January 22 there was a scant menstrual period. The following months there was only a faint show, and since then there has been no return of the menstrual flow and no bleeding. Dr. Keefe reports the patient to be entirely free of symptoms and to be enjoying a general improvement of health. This patient experienced no hot flushes or other nervous symptoms.

In the following case, the menopause was produced by one *x*-ray treatment and the fibroid was reduced fully 50 per cent. Considering the small amount of dosage given in the one treatment, this result is very extraordinary.

Case XXXV.—Mrs. B., aged forty-three, has never been pregnant. For the past year she has been suffering with profuse menstrual periods and bleeding in the intervals. This loss of blood has caused great weakness, pallor and emaciation. Pelvic examination revealed a fibroid about the size of a large grapefruit springing from the anterior abdominal wall just above the pubes. Operation has been advised, but was refused. She finally consulted Dr. Alfred Friedlander, because of her general weakness and anemia. He considered her a rather bad surgical risk and suggested a trial with *x*-ray therapy. She received one treatment on December 12, 1914, and was instructed to return to her home, which is in Kentucky, about one hundred miles distant, and to come back in two weeks for a second treatment. Instead of coming back she wrote a note stating that all bleeding had stopped and that the tumor was smaller. Up to the present date (ten months after giving the treatment), there has been no return of the hemorrhages or of the menstrual flow, and there has been a steady shrinkage of the mass. It is now less than one-third of its former size. Her general health is improved and she refuses to take any more treatments.

Case XXXVI.—Mrs. L., aged forty-two (referred by Dr. Henry W. Bettmann), began to menstruate at fourteen. The menstruations were always profuse, lasting six or seven days. She has two children. During the last six months the menstrual periods have increased slightly. On two or three occasions the intervals have been five or six weeks. Present trouble began ten weeks ago when discharge continued for thirty days steadily. During the last week of this period the bleeding became very profuse. She consulted Dr. Bettmann, who found upon pelvic examination a large fibroid. Under internal medication and alum douches the bleeding was controlled. She was then referred for *x*-ray treatment. After the administration of 400 X the menstrual flow ceased. A pelvic examination made two months after the beginning of the *x*-ray treatment revealed a 50 per-cent. reduction in the size of the fibroid.

Case XXXVII.—Mrs. T., aged forty-two (referred by Dr. W. T. Lautenschlager), was married at twenty-one and has never been pregnant. The present trouble began seven years ago with pain in the left side, left ovary, and left leg, occurring only

at the periods. The pain has continued each month since that time. The patient is confined to bed for five days each month because of pain which is so severe as to demand morphin. She was curetted six years ago for this condition but obtained no relief. Several months ago Dr. Johnston discovered a uterine fibroid about as big as an apple. More recently the periods have become very profuse as well as painful. The patient usually takes a room at a hospital at each period because of the pain and bleeding.

Five *x*-ray treatments (500 X) were given over a period of six weeks. During the treatments the patient experienced a rather severe menstrual period. The next one occurring two weeks after the cessation of the *x*-ray treatments was quite scant. The subsequent periods failed to appear. This case is of especial interest as the symptoms were chiefly those of dysmenorrhea, although there was a fibroid present.

Case XXXIX.—Mrs. T., aged 42 (referred by Dr. E. T. Knoop), had no serious illness up to present trouble except that menstrual periods were very profuse. Several years ago Dr. Knoop, who was treating the patient for some intestinal condition, noticed small fibroid in posterior wall of uterus. In September, 1914, Dr. Knoop again examined patient and noticed great increase in size of tumor. The patient was then referred for *x*-ray treatment to shrink the fibroid and avoid complications.

Seven treatments (700 X) were given over a period of ten weeks. Six weeks after the cessation of the *x*-ray treatments the menopause was established, accompanied by annoying hot flushes.

Pelvic examination by Dr. Knoop revealed a marked shrinkage in the fibroid. In this case there were neither hemorrhages nor pressure symptoms. The treatment was entirely prophylactic in purpose.

Case XL.—Mrs. P. A., aged forty-three years, was married at twenty-four years of age and had five children and three miscarriages. She has always been well up to December, 1913, when menorrhagia began. This continued off and on with bleedings in the intervals up to February, 1914, when she was curetted. This operation gave relief for only one week. In April, 1914, the patient consulted Dr. J. P. Beneke, who again performed a curettage. This gave relief for about six weeks, after which bleeding has continued off and on, especially when doing heavy work. Pelvic examination, as made by Dr. Beneke, revealed multiple fibrous nodules scattered through uterine walls.

Patient was referred for *x*-ray treatments by Dr. Beneke on February 6. From this date until April 12, the patient was given five treatments. The bleeding stopped and the menstrual periods became scant and a permanent menopause followed. The size of the uterus is considerably reduced.

Case XLI.—Mrs. M., aged forty-six years (referred by Dr. M. Salzer), has always experienced profuse menstruations, lasting a week or ten days. Four years ago the menstrual flow increased in quantity, greatly weakening the patient at each period. Last December, 1914, the flow continued the entire month. She became normal again in February, 1915, menstruating only ten days. In March, 1915, she bled for three weeks, then stopped for three weeks, then menstruated for five days, then stopped for two weeks, and again suffered a hemorrhage which lasted two weeks, at the end of which period *x*-ray treatments were begun. Pelvic examination by Dr. Salzer reveals a large uterine myoma.

The flow stopped after the first *x*-ray treatment but returned in two weeks. After the third treatment (300 X), the flow stopped entirely and has not returned. She has received a total of 600 X. The general health and strength is greatly improved. [From a recent pelvic examination (Feb. 1, 1916) Dr. Salzer estimates the tumor to be one-third of its former size.]

Case XLII.—Mrs. J., aged forty-seven years (referred by Dr. M. Dreyfoos), was married at twenty-four and has three children. For several years previous to begin-

ning treatment, she has complained of dragging pains in the pelvis, but the menstruation was always regular and normal in amount. She suffered with severe headaches at the time of the menstrual periods. Some time before beginning *x*-ray treatments, Dr. Dreyfoos found a fibroid of the uterus and recommended *x*-ray treatment with a view to checking the growth and controlling pelvic pains and headaches. Some time previous she had a fibroid removed. During the past year she has been menstruating twice in various months and suffers with pains in the left side of the pelvis. She also complains of dysuria and constipation.

Five *x*-ray treatments (500 X) resulted in a complete abolition of the ovarian functions with shrinkage of the fibroid and great improvement of the general health.

Case XLIII.—In the following case there were no hemorrhages accompanying the fibroid. The *x*-ray treatment was undertaken because of pressure pains.

Mrs. H., aged forty-eight (referred by Dr. C. N. Heisel, of Covington, Ky.), married at nineteen, had three children, no miscarriages. Present trouble started last September, with pain in lower part of pelvis and profuse hemorrhages lasting two weeks. Since September has had no hemorrhages and menstrual periods were normal. Patient complains, however, of pains and bearing down sensation in pelvis especially when walking. Pelvis examination revealed a fibroid about the size of a fist in posterior wall of uterus.

X-ray treatments were begun January 20, 1915. After the fourth *x*-ray treatment, the menstrual flow diminished to a faint show. Since February, 1915, there has been no indication of any menstrual flow and pelvic pains have abated. Patient is now able to walk about with comparative comfort. Pelvic examination, as made by Dr. Murnan, reveals a marked decrease in size of the tumor.

Case XLV.—This patient had passed the menopause and the treatments were undertaken to relieve the pressure symptoms.

Mrs. W., aged sixty-five, had a small, hard fibroid lying very low in the pelvis and pressing on rectum and bladder. She had passed the menopause and there was no hemorrhage, but she complained of distressing pressure symptoms on bladder and rectum. She obtained relief only by assuming the knee-chest posture. Surgery had been repeatedly suggested but was refused. She was very thin, anemic, and nervous.

After six *x*-ray treatments there was a sufficient reduction in the size of the tumor to afford her almost complete relief from the pressure symptoms.

Case XLVI.—Mrs. P., aged fifty-two (referred by Dr. C. E. Thompson), began to menstruate at sixteen years and was always profuse but regular. She married at twenty-four years and has one child. She has always enjoyed good health. The present trouble began three years ago with profuse menstrual periods. During the last two years she has menstruated every two weeks, the flow being so profuse as to require almost constant medical attention. One year ago she was operated for a submucous fibroid. The operation gave relief for eight months. Last April (four months before taking treatment) the flow reappeared and since July 1 has occurred every two weeks. It is very profuse, causing headache, weakness, etc. She was compelled to take a large quantity of ergot each time to stop flow. After the administration of 200 X the intermenstrual flow failed to appear, and after 300 X the menstruation stopped entirely.

The cases which have been treated for dysmenorrhea have been few in number, but the results have been very gratifying. If we can accurately gauge our dosage and suit it to the age of the patient so as to inhibit but not abolish the ovarian activity, this form of treatment will be applicable to many cases of dysmenorrhea occurring in young unmarried girls and in young married women. By carefully standardizing our dosage it should be possible to relieve the symptoms without sterilizing the patient. In the first patient that we treated

for dysmenorrhea we overdosed and produced a menopause. The patient was only seventeen years of age.

Case XLVII.—Miss K., aged seventeen (referred by Dr. H. H. Hoppe), because of excessively painful periods and almost constant intermenstrual pain which had produced a grave disturbance of the nervous system. 800 X was administered over a period of three months, resulting in a menopause accompanied by annoying hot flushes which would wake up the patient during the night. This case has been under observation over a year and the menstrual flow has so far failed to reappear.

Case XLVIII.—Mrs. G. (referred by Dr. J. P. Beneke), aged thirty-four, began to menstruate at thirteen. The menstruations were always painful. She married at twenty-three and has three children. The present trouble started five years ago, after the birth of the second child, with pain in the right side. The menstrual periods became very painful, the pain lasting considerable time after the periods. The flow persists only two days and is not excessive. 400 X produced a menopause.

Case XLIX.—Miss L., aged forty-two (referred by Dr. M. Dreyfoos), single, began to menstruate at fourteen years. At twenty-one, the periods became very painful and have been very painful more or less constantly since then. Last August, the pain associated with the menstrual periods increased in severity and persisted between the periods. The patient became very depressed and neurotic, and was confined to the house. The menstrual flow was about normal in amount.

X-ray treatments were begun December 2, 1914, and up to March 18 had received ten treatments. The menopause was established promptly. This patient experienced hot flushes during the latter part of her treatments.

In correcting the proof of this paper just prior to its publication I have modified the dosage estimations. My original dosage estimation in terms of Kienbock units was somewhat higher than represented in this paper, as now published. The above recorded estimation of the dose per skin area was made to conform with the accepted statements of what constitutes a safe dose. The above recorded doses are, however, still in excess of that of other observers in that the doses have been repeated oftener than once in three weeks. In some cases the treatments were repeated once a week.

I have no reason, however, to doubt the accuracy of my Kienbock readings, although I was compelled to use Kienbock strips and Kienbock developer which were imported shortly after the onset of the European war. The strips were, however, tested and showed no fogging. The developer was in the original sealed bottles and they had been carefully covered to protect them from the light.

Conceding, however, the possibility of error in my Kienbock readings, and not desiring to encourage the administration of excessive doses by those who have not safely standardized their technique, I have added this footnote as a word of caution as well as an explanation for some alterations in the text of the paper as originally read at Atlantic City, October, 1915.

MODERN ROENTGEN THERAPY,

INTENSIVE AND DEEP, WITH DESCRIPTION OF NEW APPARATUS FOR INTENSIVE THERAPY

BY GEO. C. JOHNSTON, M.D., PITTSBURGH, PA.

FOR many years and up until two years ago a large majority of roentgenologists employed the divided dose at frequently repeated intervals in most of their therapeutic work. There were reasons in plenty for this practice. The most important one was the fact that it was extremely difficult to obtain tubes which would permit of excitation with currents in excess of 2 milliamperes and maintain a high penetration under this load for periods longer than 10 minutes. If tubes were employed which permitted the passage of larger currents than 2 milliamperes the rays emitted from such tubes were largely those of low penetration, and if much filtration were employed the total quantity of rays beyond filter was very small, so that, while the m.a. reading was higher, yet the efficient radiation beyond the filter was actually less.

The advent of the Coolidge tube, however, has placed the whole domain of roentgen therapy on an absolutely different basis. The time has now come when it is possible to prescribe the exact dose of radiant energy which it is desired to administer over any prescribed area, and it is now possible for one roentgenologist to tell another what has been done in any given case where results have been obtained. Mensuration, which is the basis of all science, is now much nearer to an accomplished fact in our art than ever before. Moreover the possession of such a source of radiant energy as is afforded by an air-cooled Coolidge tube actuated by a transformer capable of a voltage in excess of 100,000 volts permits us to apply to any desired area in a reasonable length of time the total number of units of highly penetrating radiation capable of being absorbed at that point without destroying the skin. We are actually able to give at a single sitting at a single portal of entry approximately 30 times the old-time dose.

If the lesion to be attacked is a superficial one, an epithelioma of the skin for example, and no filtration is employed it is a simple matter to apply 60 to 70 X in a few minutes with results that must be personally observed in actual practice before one is able to believe them to be actuality. Slides illustrating some of these cases will be shown later and attention called to the simple technic productive of the results shown.

PROPHYLACTIC RADIATION

The excellent results obtained in recurrence following operations upon the mammary glands for example, has stimulated the interest of the general surgeon in the prophylactic use of the ray following operation and before recurrence has had time to appear. We have noticed within the last year a decided increase in the number of patients sent immediately after operation for such prophylactic ray and we believe this to be due to the impression made upon the surgeon by the remarkable results obtained in cases of extensive recurrence where intensive radiation has been employed. The mind of the operator has been so impressed with these results that he cannot fail to see the wisdom of submitting these cases for radiation immediately following operation feeling certain that the entire area will thereby be sterilized and any small foci which would later manifest themselves as recurrent nodules, be destroyed before they had time to make mischief. I must here advocate the uttermost boldness in dealing with

recurrent malignancy. The sole question to be considered to my mind is this, "How much intensive radiation is required in this particular case to utterly destroy the recurrence present?" That having been determined, that quantity of radiation is applied with but little consideration for the fact that such a dosage may result in extensive dermatitis. The death rate for recurrent malignancy is 100 per cent. The death rate from dermatitis is nil. Also in every case that I remember where recurrence of malignancy has followed operation in spite of post-operative radiation, the recurrence has either been outside the limits of the radiation or the total amount of radiation applied has been too small, therefore the only safe and sane post-operative radiation is that which consists in quantity per square centimeter as great as the skin will tolerate and the area irradiated should be as extensive as possible. For example, following removal of the breast for malignancy, the opposite axilla, the mediastinum, the anterior chest wall, the scapular region, the supraclavicular region, the triangles of the neck, the region formerly occupied by the breast, the axilla and the under surface of the arm on the affected side should all be extensively radiated. The radiation should extend as low as the ribs in front and behind and in the axilla. Moreover, each of these areas must be irradiated separately, and if this be done the mediastinum and the subclavicular region will have received a rather extensive cross-firing. By the way, at this point, I will call your attention to the silliness of cross-firing or attempting to cross-fire skin areas such as epithelioma of the skin. It is not only unnecessary but the use of such a technic and of such an expression betrays an ignorance upon the part of those employing it of the sole reason for the employment of the cross-fire method, which is to obtain at a point beneath the surface a dose of radiation greater than can be obtained there if directed at this point through one area of skin on account of the law of inverse squares governing such radiation.

For some time we have been dissatisfied with our method of treating post-operative carcinomatous breasts and recurrences in that region, particularly the difficulty in applying the desired dosage to the axillary region. We therefore devised a piece of apparatus which, while both clumsy and crude, yet has enabled us to entirely overcome our previous difficulty and to administer to rather inaccessible regions the enormous doses of radiation which our present technic demands in order that we may produce results. Briefly, the apparatus, a crude model of which is here shown, consists of

FIG. 1. Coolidge tube treatment device in use roentgenizing the axilla. Patient's arm on the side under treatment rests comfortably on the top of the box which is grounded to water pipe. Observe small lead glass window in center of box for observation of tube, air-hose directing compressed air against anode through back of box to tube terminals.

a large wooden box heavily protected, top, bottom, front and ends with thick lead; the back of the box is a door covered with a heavy layer of protective rubber. In practice this door is in the inactive hemisphere of the tube. The box is designed primarily for the protection of the patient, the operator being adequately protected by a ray-

proof booth. In the center of the box the lead is cut out for an area 3 inches wide over half the top, half the bottom and all of the front. Inside the box this area or slot is covered by an aluminum filter, 3 mm. thick, on the outside next to the patient the lead is replaced by a leather filter 4 mm. thick. There is therefore interposed between the patient and the source of the ray 3 mm. of aluminum, 7/8 inch of wood and 4 mm. of leather. This 3-inch slot through which the rays emerge can be modified by various lead shutters. For example, in the treatment of the axilla the patient's arm is extended at as near a right angle from the body as is possible without giving pain to the patient. The arm is flexed at the elbow and rests upon the top of the box, the patient sitting in the chair beside the apparatus; the center and bottom aperture is closed by a lead obturator. The box, while very heavy, since only thick lead is effective, yet by means of a worm drive moves slowly yet easily up and down and the position of the box can be thus adjusted to suit the height of the patient. The distance from the anode to the outside surface of the box is 5 inches. The patient is placed in actual contact with the apparatus. The square of 5 is 25 and the square of 7 is 49. It is thus seen that a dose may be administered in one-half the time on this apparatus that is required in working with one having a minimum anodal skin distance of 7 inches. One of the advantages therefore is that the patient need keep the arm elevated but one-half the time required when the ordinary apparatus is used. Another inaccessible area is the supraclavicular region. No intelligent roentgenologist will deny the necessity of the most thorough radiation of this area in every case of malignancy of the breast, yet on account of its inaccessibility I greatly fear that it has often to go with but a fraction of the dose that prudence demands it should receive. With the apparatus here shown, the box is elevated to the top of the frame, as much of the bottom and front slot as desired is exposed, the patient sits with the shoulder under the apparatus, the head of the patient resting against the front of the box, the result being that the triangles of

FIG. 2. Device in action roentgenizing supraclavicular region, side of neck and mediastinum. Tube is rotated toward lower anterior edge of box.

FIG. 3. Roentgenization of floor of mouth and suprasternal region. Tube is rotated so that target faces upper anterior edge of protective tube.

the neck, the angle of the jaw, the submaxillary glands and the scapular region are thoroughly radiated. Moreover the radiation being directed downward with an angulation of 45 degrees from the perpendicular strikes directly toward the superior mediastinum. This is one of the ideal positions for the cross-firing of the mediastinum.

The same position on the other side may be employed when it is desired to continue the radiation of the mediastinum. The other positions required in the radiation of the trunk readily suggest themselves and do not require explanation. The skin of the patient is marked out in areas corresponding to the aperture in the lead, in this way overlapping of the intensive radiations employed is avoided. We have found in common with most other observers that about the limit is 30 X to a given area at a single sitting which must not be repeated within 3 weeks. It is not always safe, but we prefer to employ large doses, taking some risk of resulting dermatitis, and we have been favored with a dermatitis in a number of instances. (We, however, explained to these patients who complain of dermatitis that we feel that they should not consider it when such large stakes were being played for.) To return to the consideration of the apparatus, a strong blast of air is forced against the anodal neck at the junction of the bulb. This apparatus possesses several advantages which are not immediately apparent. First, the tube is invisible to the patient. We have found that some patients are afraid of Coolidge tubes on account of the incandescence of the cathode With this apparatus the fear of burns does not occur to the patient, although they are actually much closer to the tube than with the ordinary apparatus. Second, it is impossible for the patient to receive any electrical shock, the apparatus being grounded. Third, the radiation is confined absolutely to the area desired. Fourth, a considerable degree of protection to the operator and attendants is obtained. Inaccessible areas are rendered accessible and finally on account of the intimate relation of the tube and the part under treatment, much less time is consumed in applying the given quantity of radiation.

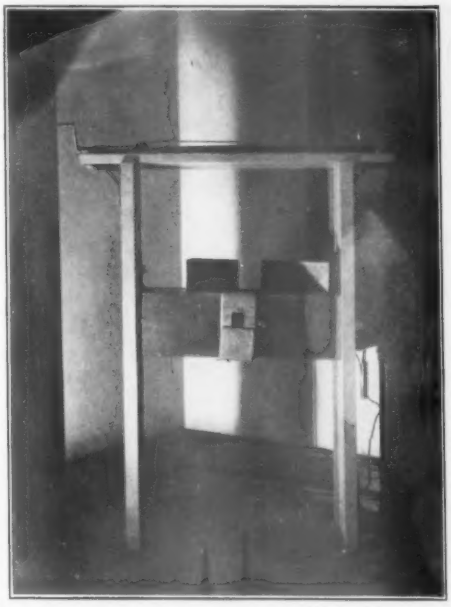
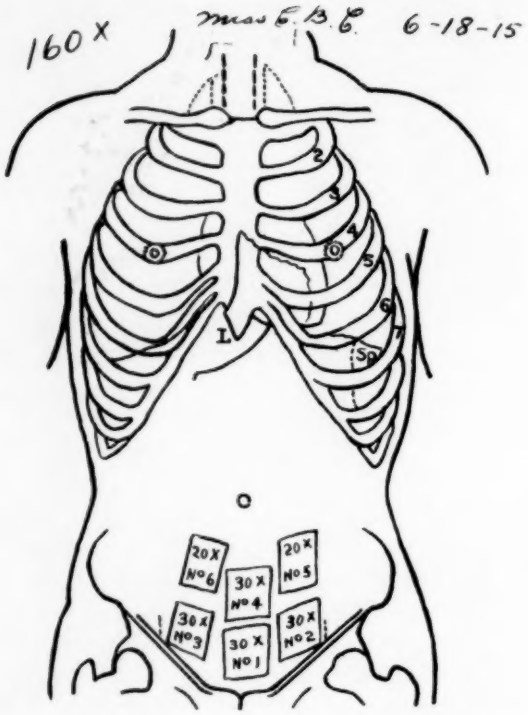


FIG. 4. Anterior view of device showing the active area reduced in size by application of lead obturators. The bottom of the box has an active area 4 inches by 6 inches long occupied by a leather and aluminum filter. There is also an active area 4 inches wide and extending the entire width of the face of the tube which can be made to assume any lesser size by means of obturators. There is also an active area 4 x 6 inches on the top of the box. Any part of any one of these areas or parts of them may be employed at the same time. The box has a range motion of 5 feet and is raised and lowered by means of a worm-drive, shown on top of transverse member.

INTENSIVE THERAPY IN THE TREATMENT OF SUPERFICIAL LESIONS, PARTICULARLY MALIGNANCY OF THE SKIN AND SUPERFICIAL RECURRENCES

Our technic has undergone a decided change within the last year. We now employ at a single sitting or at the most 3 sittings, the total quantity of radiation necessary to promote those changes in the tissue which constitute a cure. Except about the eyelids we usually administer at a single sitting 40 to 70 X, depending upon the severity of the lesion, this of course without filtration of any kind, and the radiation employed having a penetration sufficient to



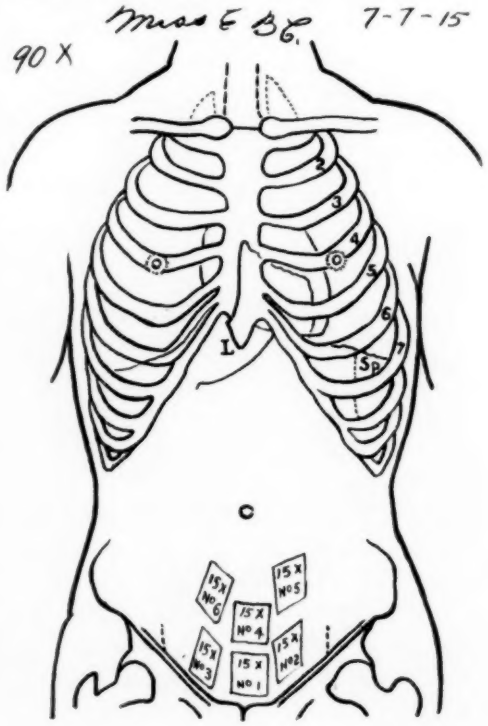
send it well beneath the depths of the lesion. We are unable to see the advisability of using for this class of lesions a radiation having a penetration equal to 4 or 5 patients.

Where the lesions involve the eyelids, it has been our custom to not exceed 20 X at a single dose since the inflammatory action obtained from larger doses is rather alarming to the patient if permitted to occur about the eyes. As to the results obtained by such treatment, I wish to show you the following slides: These cases of carcinomas about the eyelids are rather interesting to me on account of a statement emanating lately from a prominent surgeon that all such lesions can only be treated by radical surgical excision. In all the cases just shown, such operative procedure would have involved an evisceration of the orbit. These cases have responded nicely to three sittings of five minutes each, the entire dose could have been administered at a single sitting of ten minutes. In the face of such results the necessity for large quantities of radium seems rather remote and the author's nights are not disturbed by the state of the radium market. As to the permanency of these results we have similar cases treated by the old methods of radiation 10 and 12 years without evidence of return, I can see no reason why these cases should not prove equally permanent.

DEEP ROENTGEN THERAPY

The results obtained by Krönig and Gauss in the treatment of uterine fibroma undoubtedly did more to attract the attention of the profession in general to the possibilities of deep roentgen therapy than anything with which I am familiar. While they were not the originators of the cross-fire method with multiple portals of entry, yet their work popularized this method of treatment. Personally, the writer, prior to the advent of the Coolidge tube, was unable to obtain any brilliant results simply on account of the practical impossibility of obtaining sufficient radiation at the required depth within the tissue.

With the Coolidge tube air-cooled, passing 6 m.a. at 90,000 volts with the tube at an anodal skin distance of 7 inches it is pos-



sible to produce a very decided effect upon the uterus and ovaries even when protected by a thick abdominal wall. In our treatment of uterine conditions we have found it necessary to employ not more than six portals of entry upon the abdomen and a corresponding number on the back. The following two cases illustrate our technic and the results obtained and are employed as typical of their class.

Case I.—Miss E. B. C. Polypoid uterine mucosa, excessive hemorrhages. Curettage fails to relieve hemorrhages, which are excessive and continuous, and Dr. Simpson does not wish to ablate uterus if it is possible to avoid it. Hemorrhages have been controlled by rest in bed and coagulose hypodermically. The first series radiation June 18th, consisting of 160 X, 3 mm. al. and 3 mm. leather, as indicated on chart. Bleeding stopped 3 days later and she left hospital. No untoward symptoms followed above dose. July 7, 1915, 90 X total on areas as shown on chart as some bleeding had developed following her first treatment. July 23, 1915. Perfectly well. No more bleeding. August 7, 1915. Well—hot flashes—no menstruation.

In this case an ablation of the uterus and tubes was avoided by two simple series of treatments. Two years ago, however, the administration of such doses in a single day would absolutely have been impossible.

Case II.—Mrs. H. Age 40 years. Referred by Drs. Ziegler and Lichty. A small fibroid of uterus, marked continuous hemorrhages. Anemia extreme. 1,000,000 reds, 30 per cent. hemoglobin. Floods for fifteen days at a time. Patient has cardiac dyspnea, all mucous membranes colorless, skin waxen. Conjunctiva white. Patient received 1160 X during three months in three series of treatments. It has been our experience that the more extreme the anemia of the patient, the less response they will be found to have to radiation. This patient has made a perfect recovery, is the picture of health and she and her husband have been most flattering in their gratitude.

As a type of deep-seated abdominal malignancy, the case of Mrs. M. referred by Dr. Cheesman may be of interest. This young woman was operated upon by Dr. Cheesman for carcinoma of the uterus, an abdominal hysterectomy being performed. The disease was so extensive that complete surgical eradication was impossible. She was therefore referred for post-operative radiation in the hope of delaying metastasis. She received some rather severe radiation through multiple portals of entry and divided doses with some sloughing of the skin, but it is now a year since her operation and treatment and she is apparently in perfect health. She is getting fat, rosy cheeked and does not believe that she has had anything serious the matter with her. If it were not for the fact that we know exactly what the interabdominal conditions were in this woman through the exploration at the time of operation we would hesitate to believe that she ever had carcinoma so extensively as we know to be the case.

Osteosarcoma of the pelvis in several cases has shown itself quite amenable to deep roentgen therapy. Also a case of osteosarcoma of the scapula, Mr. G. A. S., referred by Drs. Litchfield and Mechling, pronounced inoperable by Dr. Bloodgood of Johns Hopkins, pronounced curable by one treatment with radium by Dr. Howard Kelly, of Baltimore. Not possessing either the quantity of radium or the assurance necessary to make such statements, we were compelled to employ such skill as we possessed with deep therapy. 1040 X units were administered by the cross-fire method over numerous portals of entry, the entire scapula being involved in the disease. Within 4 months the progress of the disease was checked, the pain in the shoulder had practically disappeared, the size of the scapula was less. Radiograms of the shoulder show no further progress of the disease and no demonstrable metastasis has occurred. The patient, however, shows evidence of absorption of toxins from the large quantity of disease tissue irradiated and has been re-

ferred to Dr. Coley, of New York, who believes by the administration of his combined toxins he can counteract the absorption.

In a case of round-celled sarcoma of the ninth, tenth, eleventh, and twelfth ribs, Mr. L. L. H., referred by Dr. A. E. Ewing. This inoperable tumor mass in a man aged 40 years has disappeared under intensive deep therapy by cross-fire method, 170 X having been administered within 3 weeks. In this case as well, the quantity of radiation to effect a cure was so great that the integrity of the skin necessarily suffered in spite of a number of portals of entry being employed.

CONCLUSIONS

Intensive radiotherapy intelligently employed is capable of producing quick destruction of superficial malignancies without pain in from 1 to 3 sittings, even in such delicate locations as the eyelid with cosmetic results that are not obtainable by any other method.

Prophylactic radiation, post-operative, should be carried out conscientiously over a wide area beyond the apparent limits of the disease and sufficient radiation employed to insure the complete sterilization of the tissues.

Deep roentgen therapy is capable of producing quickly, painlessly, and safely, artificial menopause in hemorrhage and various gynecological conditions.

The prognosis of malignancy is not necessarily measured by the given extent, location or character of the disease. The most brilliant results sometimes follow treatment of the most apparently hopeless cases.

The advent of the Coolidge tube has increased the possibilities of roentgen therapy to a remarkable degree. It has increased the necessity for skill upon the part of those employing it to a corresponding degree.

The roentgenologist who estimates or assumes rather than measures the dosage administered will not long continue the employment of deep or intensive radiation. The man who guesses at the doses employed in modern radiotherapy may find himself held responsible for unpleasant results. It is not necessary to measure every dose administered by means of a pastille if the operator is sufficiently skilled to be capable of exactly duplicating his dosage, but even then it is wise to frequently check the other methods of estimation employed by means of the pastille.

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DISCUSSION ON THE PAPERS OF DRS. ZULICK AND PFAHLER, LANGE AND JOHNSTON

Dr. F. H. Baetjer, Baltimore.—I have been greatly interested in deep therapy of the thymus. Dr. Walters has been doing some experimental work on the thymus in my laboratory. In our routine chest examinations we noted a shadow extending down the right side of the sternum which we could not account for. We thought that it might be caused by the thymus. We knew that after operations on the thyroid some patients do not get well, and, therefore, we wondered whether this might be attributed to the thymus. I believe that the thymus is enlarged in these cases, although the roentgen ray may not show a shadow, because the edges of the gland may be as thin as tissue paper. Then we treated the thymus in all thyroid cases, carefully avoiding exposure of the thyroid to the ray by covering the body with heavy lead foil. We began by giving one point every other day, then one every day, and finally we learned that the best results were obtained by giving a single heavy treatment. In some respects this treatment has been very satisfactory, and in others it has been very disappointing. We have not yet been able to determine in which cases this treat-

ment should be used, and in which it should not be used. We have been working in an empirical way. We always give the thymus treatment first, and if there is no improvement we advise operation.

Dr. Rollin H. Stevens, Detroit.—I have used a fan so that the breeze blows directly on the patient. That gives some relief. The best method is to divide the dose, completing it in two consecutive days. It makes very little difference as to nausea whether the abdomen or the chest is treated. In treating my cases of recurrent cancer of breast I treat through the side, front and back of the chest through 24 to 30 ports, and give 20 X at a dose. These patients do not seem to complain as much of nausea as patients treated similarly through the abdomen. They have very little nausea in comparison. I also cover the face and mouth with a towel, which seems to help some. All patients complain of the "smell of the ray."

Dr. George E. Pfahler, Philadelphia.—One of our physiologists, Dr. Downs, told me recently (speaking of the interrelationship of the thyroid and thymus), that enlargement of one of these glands stimulated enlargement of the other. He suggested that these exophthalmic goiter patients might have an enlarged thymus—that as the result of shock, nervous strain or some such condition, the thymus becomes enlarged and secondarily causes an enlargement of the thyroid.

Referring to Dr. Lange's paper, I consider it risky to repeat such a dosage every week or even every two weeks. A few years ago I repeated the dose after two weeks in an abdominal case, and got a severe roentgen ulcer.

I believe it is better to go slow in these conditions. I treated one case of pedunculated fibroid, and there was 75 per cent. reduction.

Dr. Geo. C. Johnston, Pittsburg (closing).—Dr. Chas. F. Bowen read a very good paper on thymus enlargement several years ago, and called attention to the fact that surgeons should not take out a thyroid without looking at the thymus. The treatment of exophthalmic goiter is very satisfactory. I had only three cases come to operation. One patient was operated on for thyroidphobia. Before the operation her pulse was 82; she had no tachycardia; no exophthalmos; no sweating.

Another patient was operated on after the thyroid enlargement had disappeared under treatment. She was told that she had an intrathoracic thyroid. I did not discover it. I have some patients now with such a condition. One woman was in bad shape from pressure. She had much dyspnea and enlargement of the thyroid, exophthalmos and symptoms of hyperthyroidism. She is getting thymus treatments in addition to thyroid treatments. I treat both glands.

Dr. Sidney Lange, Cincinnati.—With regard to the ease of accomplishing results, I have been passing ten milliamperes through the tube at six inches, giving the dose to each skin area in two and a half minutes, so that it takes only ten minutes of actual raying for each treatment. I have given this two weeks in succession, and then stopped two weeks. With the method I described I have been giving even more than that, but since speaking with some of the men here I do not think I shall attempt to repeat such doses as I have recorded in my paper. Perhaps the alkaline lotion had something to do with delaying the skin effect. In the treatment of fibroids, we stop as soon as the first period is missed.

Dr. Johnston's paper upon deep therapy in general recalls three very interesting cases that I have recently treated in which very brilliant immediate results were obtained.

One case was that of a colored man with sarcoma of the upper jaw, exophthalmos, blind in one eye and occlusion of the nares. I subjected him to deep therapy, with a splendid result. The exophthalmos disappeared, vision was equal in both eyes; the nares were open, and the foul odor of the discharge had stopped. He had a little epidermitis.

THE LOCAL APPLICATION OF RADIUM SUPPLEMENTED BY ROENTGEN THERAPY

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ROENTGENOLOGIST, ALLEGHENY GENERAL HOSPITAL; DERMATOLOGIST AND ROENTGENOLOGIST PITTSBURGH, COLUMBIA AND ST. FRANCIS HOSPITALS

THE therapeutic action of a local application of radium is due to rays emitted, which penetrate the tissues and therein produce certain changes. The character and extent of changes depend upon the quality and quantity of the radiation. Weak radiation may stimulate the cells, while larger doses inhibit cellular functions and finally cause death. Every cell is susceptible to this stimulation or inhibition, but the effect varies in degree with the cells of different tissues as well as with the dosage. Thus the glandular epithelium of the testicle, ovary, breast, liver, spleen, thymus, thyroid and lymphatic glands is more susceptible than the stroma of the same organs.

Investigations have shown that both the rays given off radium and the *x*-ray tube act primarily on the nuclei of the cells and inhibit their power of proliferation before the function of the cell is impaired. Embryonic cells and those which are undergoing active proliferation are the most susceptible. It has been shown that malignant growths are retarded by radiation and become less malignant, although they may not have diminished in size or disappeared. By further increasing the quantity of radiation, the injury becomes more pronounced and the cells are completely destroyed, the rays acting differently on the various types of cells, i. e., destroying one kind of tissue and leaving the other adjacent tissues intact or so slightly injured that they will completely recover.

The therapeutic action of radium on a new growth not only consists in the destruction of the tumor cells but also in its action on the blood-vessels. The endothelial cells of the intima degenerate, the lumina of the vessels retract and finally are obliterated and consequently the tumor cells cannot obtain the nourishment needed for their maintenance of life and for their proliferation.

When a tube of radium is brought in contact with a growth or is inserted into it, a certain dosage will inhibit the proliferation and finally cause necrosis of the cells nearest it, while further away from the tube the same kind of cells will be stimulated. This observation has been made by many and is a settled fact. The statements made as to the depths in which the cells are affected vary between two and five centimeters, two and one-half being that which is generally accepted. So radium has its limitations in the treatment of malignancy and must be supplemented by something which will destroy the metastasis in the deep lymphatic glands which cannot be reached effectively by radium rays.

The quantity of rays reaching tissues adjacent to the radium tube diminishes inversely as the square of the distance. The more susceptible a cell the smaller the dose necessary for its destruction and consequently the greater the distance at which it may be influenced; since the rays decrease as the square of the distance from the radium, it necessarily follows that tissues acted upon must be as close as possible, and whenever it can be arranged, the abnormal tissue should be brought in contact with the radium container, while the normal tissue should be as far as possible from it. When large growths have been treated, it has been determined by biopsy that the periphery of the growth is stimulated by the attenuated rays

that are able to reach through, while the malignant cells in the tissues in contact with the radium are destroyed. Many have long realized, since light decreases inversely with the square of the distance and if the source of radiation is placed in contact with the skin of the patient, that the dose is many times stronger on the surface than at a depth where the disease must be destroyed. The greater the distance the source of radiation is placed from the surface of the body the more nearly the tissue at a depth will be rayed homogeneously. With an *x*-ray placed twenty inches from the surface, a growth situated four inches below the surface will receive almost the same amount of radiation as the skin less the amount cut off by absorption of the four inches of tissue. Some radium workers who have large quantities of radium, have placed it at a distance, thereby reaching a more nearly homogeneous radiation than by bringing it in contact with the surface of the body, but until they can obtain many grams of radium this is not any more practical than attempting to treat cancer of the uterus with five milligrams of radium locally and expect results.

As it greatly increases the time of exposure to increase the distance of the source of energy, a roentgen tube should be placed as close as possible without impairing results at the desired depth. The shortest distance can be determined only by the amount of radium radiation given locally as well as by the amount of cross-firing. Of course the loss by absorption must be supplemented by cross-firing.

The general opinion at present is that all malignant tumors are in their early stages merely local, so that a complete cure may be obtained by early and complete removal. Unfortunately no clinician is able at least to state when such is the case; the facts are quite otherwise. Generalization and recurrence in the cicatrix and the glands frequently follow even when the tumor has been completely excised in its early stage. So frequently is this the case that we are bound to conclude that the disease is regional and not entirely local from the beginning, even before the neoplasm is recognizable by the naked eye, because the whole of the lymphatic circulation as well as the glands is already infected.

This is shown by the fact that recurrence is frequently seen in the cicatrix of an incision at a considerable distance from the original lesion. Leduc states: "For some considerable time after this regional infection by malignant disease, the lymphatic glands are able to defend the organism against the general invasion of the disease. The glands here play a double rôle: they are both fortress and garrison, arresting the invasion, and defending the organism against the entrance of the pathological germs."

If his deductions are correct the surgical removal of the lymphatic glands even in a very early operation for cancer is to be deprecated, unless every part of the garrison, i. e., the lymphatic glands, which are holding metastatic cancer cells, is removed at the time of operation. Otherwise it removes the only barrier to the invasion and the only defense of the organism, thus hastening the end. We are sure that the surgeons would not operate on a great many cases that they do if the visceral generalization had been as easily recognizable as the local recurrence in the glands or scar, or if they would have had these cases treated most thoroughly and radically by modern radiation. An incomplete surgical removal neither prolongs life, retards the progress nor affords palliation, but rather hastens the progress. This is not true of radium applied locally because the lymphatics are never opened, but it has the disadvantage of not giving off rays which will act at sufficient distance from the radium tube to destroy the cancerous cells in all the adjacent lymphatics.

Experience of the past two years has shown that we cannot treat successfully with radium at a greater distance than two, or a maximum of three centimeters. It has been universally accepted that cancerous growths

can be promptly, and also apparently permanently, cured at this depth from the radium tube. If, however, the disease is advanced and there is infiltration of the growth into adjacent lymphatics, the cure is only apparent. The local growth may disappear but if metastasis had taken place before the treatment was given, it will progress, no difference how much or how long the radium is applied if it is only effective from two to three centimeters from the tube.

Larger quantities of radium have been tried and by increasing the time of exposure to influence cancerous cells at a greater depth, but the universal reports show that not much success has been accomplished in this direction. The overlying tissues were damaged beyond recovery regardless of the kind of filters employed. The rays of the radium in contact with the growth were too intense where they entered and too weak at a greater distance from the tubes than from two to three centimeters. To place the radium at a distance from the surface in order that the rays will be nearly uniform at the point of entrance and at the distance required renders the radiation too weak even if several grams were employed. The same is not held true of the present *x*-ray tube which, when powerfully excited, gives off many thousand times more rays than any quantity of radium any one has ever used. It has been estimated that ninety-two grams of radium would be necessary to place the radium at the same distance in order to obtain at a depth of ten centimeters the same intensity of radiation as with the *x*-ray tube.

Warnekros, in order to compare the relative quantities of the rays from an *x*-ray tube and radioactive substances, introduced Kienböck strips into the vagina of patients suffering from carcinoma and rayed the abdomen by roentgen tubes at a distance of twenty-two centimeters from the skin. A partial account of these tests is given in the *Archives of the Roentgen Ray Journal,* May, 1915, which is very instructive. Bumm and Warnekros concluded as follows in regard to the hard roentgen rays on deep tissues: "We estimate that, in the treatment by roentgen rays of visible malignant growths one needs a quantity of about 300-500 X, in order to destroy and heal growths of two centimeters thickness. The same quantity of 300-500 X must reach the depth of tissues if deeply situated cancerous tissues are to be destroyed. The depths which come into consideration reach to about ten centimeters. Our experiments and observations on dead and living persons show that at a depth of ten centimeters, when Kienböck strips had been introduced into the cavity of the vagina and had been subject to radiation from the outside of the abdomen, the intensity diminishes from 100 to 15, that is to about 1/7 of that at the surface. To obtain, at a depth of ten centimeters, 500 X, we must give to the surface 3,500 X, and in order to apply this great quantity without serious damage to the upper tissues, only hard rays must be used, with a sufficiently large distance from the skin, according to the principle of homogeneous radiation by E. Dessauer, and the rays should enter the body through different parts. Our experience shows that all this is possible, and that it produces the same results in deep-seated cancers as are obtained in superficial growths."

In the treatment of any form of malignancy, the proper quantity of radiation must reach the diseased tissue, otherwise good effects cannot be obtained. Clinical experience has proved again and again that permanent results mean more than superficial treating and removing the visible part of the disease. Cures by such treatment are only apparent, with relapse in a short time. Attempts to cure malignant tumors with inefficient radiation have only led to incomplete success. The roentgen ray has been found to be the only agent which is capable of checking and permanently curing well-established malignant growths in which extensive involvement has taken place, although radium is far superior in its local action on any mass situated in cavities where it is necessary to concentrate the rays.

Therefore, radium applied locally, supplemented by roentgen rays to the adjacent tissue, gives the ideal form of radiation because all the malignant cells can be stronger rayed with less injury to the healthy tissues. This is a fact beyond dispute. It has been proved without doubt that many cases of inoperable cancer of the uterus have been apparently cured by radium alone applied in the vagina; and also by our present roentgen methods alone, but a combination of both carried out scientifically seems the practical method and should cure more advanced cases than either alone.

Both surgery and radium are local methods of treatment and metastases in distant parts are beyond their reach in a large majority of cases. The disadvantage of surgery is that it removes a large amount of healthy tissue as well as the abnormal. There is always a limit to the removal of normal tissue by the fact that the vitality of the patient is interfered with and consequently hastens metastases of the malignant cells left in adjacent tissue. The advantage of radium is that it will destroy the malignant cells without injuring the normal. It does more than cautery or removal. It destroys the cancer cells, leaving the healthy tissue. The disadvantage is that, with any known technic, the rays do not reach beyond a certain depth and, while the disease in the superficial layers is destroyed, it is only inhibited or unaffected in deeper parts. This shows the necessity of using radium in cavities, cross-firing as much as possible or inserting the tube in the growth and raying the adjacent lymphatic supply as thoroughly as possible. We are still looking for the homogeneous ray. I believe that radium is the ideal form of radiation for a depth of two and one-half centimeters. We are expecting Professor Coolidge in the near future to have a tube which will give us this form of radiation. It is in this direction we are looking because surgery has about reached its limit. While the radium workers' results have been wonderful since filtration and cross-firing have been used, they realize that until large quantities of radium have been obtained, this form of radiation, like surgery, has about reached its limit.

Before this society it is unnecessary to go into detail of describing the value of homogeneous radiation and how to obtain it. But I wish to call attention to the fact that most of the radium institutes are not treating the metastases with roentgen rays and for this reason their results are inferior to many of the Germans', who never use radium alone in advanced cases. Do they neither know the limitations of radium nor the value of roentgen therapy? This, I believe, is one of the reasons why many of the radium reports read thus: "This caused the disappearance of the growth. One year later the patient died of metastasis without recurrence." It appears that these radium workers are in the same place that the noted surgeon Gross was when he made the statement that he had not cured a case of cancer of the breast in twenty-five years by the removal of the breast. During the last three years I have frequently seen cases which have been treated by radium in different places which would bear out this statement.

In epithelioma or carcinoma of tongue, mouth, throat, lower lip, uterus or rectum, the disease is seldom seen and diagnosed before the adjacent glands are involved. In many cases the glands are not palpable but metastasis takes place long before the glands can be detected by palpation. This is something every physician should know by this time with the amount of emphasis most authorities have placed upon this fact, but I do not believe that some of the medical profession will ever learn it. Even some well-informed surgeons will tell you that they have removed all carcinomatous tissue and that post radiation would be superfluous. It is absurd for any one to be guided by tactile sense in determining whether there are cancer cells in the adjacent lymphatics. Sad experience in the past has proven this to be a fact. Do they not know the nature of cancer?

It is becoming a universal fact that the

removal of a cancerous growth locally and as much of the adjacent lymphatic tissue as is possible, or the disappearance of the local mass by radiation, is a contradistinction to a cure. This might be considered a clinical cure, but a cure means the permanent removal of a malignant growth and its nonrecurrence in any other part of the body. The rationale of the complete removal must include modern radiation, because even in the very early cases complete removal by surgery, no difference how early and how radically performed, only removes the disease in a certain percentage of cases. A continued study of the lymphatics in their relation to carcinoma for over twenty-five years has led to more radical operations for their removal and has increased the numbers of cures by surgery, but still the most radical methods will only cure a fair percentage of the early cases. Bloodgood states that when deep-seated cancer is clinically malignant it is usually hopelessly inoperable. The many long and tedious operations for cancer of the breast, the most radical operations for cancer of the uterus, bladder, rectum and throat, must at least be supplemented by modern radiation which makes it more radical in order to cure the highest percentage of cases. The members of this society who have been advocating the addition of radiation to surgery, should at least be gratified that they have succeeded in convincing the best surgical authorities of this fact. Many of the surgeons realize this more fully than some of the members of our society, who are making roentgen examinations of the highest degree and doing very little radiotherapy. Our society has done much in the past and has much to do in the future to standardize methods and educate the medical profession.

The latest surgical authorities recognize the value of modern radiation as a necessary adjunct to operation and as a palliative procedure in the hopeless cases. In this connection let me cite several paragraphs from "Johnson's Surgery," just issued: "Extensive indurated cutaneous epitheliomata involving the subcutaneous and unlerlying tissue, even with bony involvement, are as successfully treated by massive doses of light, moderately filtered radium as by surgical intervention and, when successful, with far better cosmetic results. . . . Inoperable lesions can be regularly reduced and the pain and discharge diminished, and latterly, with the larger amounts of radium at our disposal, a total dissipation has occasionally resulted with a fair prospect of permanent relief. . . . Inoperable tumors can sometimes be made operable and a cachectic general condition can often be greatly improved by radium applications to the offending mass or masses. The increasing success, as shown by results reported in the more recent years, undoubtedly has been due to a concentrated effort to project greater masses of rays more equally distributed throughout the tumor and the immediately surrounding tissues. . . . Epithelial cancers of the uterus, rectum and breast have seemed to be more influenced by radium treatment than the other inoperable or recurring epitheliomata. . . . Carcinoma of the cervix and uterus is anatomically well situated for radium applications, owing to its tendency to spread around the walls of the organ, leaving the cavity of the vagina, cervix and uterus patent for the insertion of radium tubes on various applicators or in catheters. A 50-mg. tube of the element filtered with 2 to 4 mm. of foil and left in place for 24 hours will relieve pain, hemorrhage and discharge and, in a few rare cases, the lesion has entirely disappeared over a period of months after radium treatment, the cervix and uterus tending to resume somewhat their original contour and appearance. . . . Such applications to inoperable carcinoma of the rectum have occasionally prolonged life for months and even years and saved the patient the discomfort of an artificial anus."

The symposium on "Cancer of Certain Pelvic Organs," read before the Massachusetts Medical Society, June 9th, from a clinical standpoint should be studied by every one interested in the treatment of malig-

nancy. This symposium emphasizes the importance of still more radical operations than have been heretofore performed for carcinoma of the pelvic organs, or else the addition of radium and the *x*-ray or some unknown treatment before we are able to cure a majority of cases which can be diagnosed clinically. The surgeons who took part in this symposium were not only surgeons of the highest rank, but each had specialized and directed his attention to only one of the pelvic organs. For the past two and a half to three years in the Massachusetts General Hospital all the cases of cancer of the uterus have been assigned to Dr. Farrar Cobb for operation and all the cases of cancer of the rectum have been assigned to Dr. Daniel Fiske. This has undoubtedly allowed each to perfect his technic to a high degree and their statements are worthy of very careful consideration. Cobb's description of the Wertheim operation in the following words certainly should prove to us that applying radium locally in the vagina would not eradicate the metastases in the adjacent glands when the removal of the tissue at such great distance from the local growth is found to be necessary: "The radical abdominal or Wertheim operation is concisely the removal of the uterus and a liberal portion of the vagina through a median abdominal incision, with thorough dissection of the ureters and bladder with removal of as much of the parametrium on both sides as possible, the regional lymph glands being removed only if palpably enlarged. The operation is a difficult and tedious one, and the medical profession and public should be made to understand that it is an operation only to be attempted by surgeons especially interested and trained in this work."

Since according to Cobb, 50 per cent. of all cancer of the uterus cases come too late for curative operation and of the operable cases only 50 per cent. are cured, and there is an operable mortality of from 9 per cent. to 30 per cent. and so much can be accomplished in the hopelessly inoperable cases, it does not seem presumption to suggest that each cancer patient should at least be given the benefit of modern radiation. This certainly shows that Cobb considers the ordinary operation incomplete when he advocates such a radical operation as can be done only by the most skillful and especially trained surgeons. Even then the immediate mortality in a series of cases reached as much as 25 per cent. to 30 per cent. Such a radical operation in selected cases only cures 50 per cent. of the cases operated upon. His address to any one who is at all familiar with the results of modern radiation, strongly advocates radium applied locally and the raying of the entire lymphatic supply of the pelvis by the most efficient roentgen methods. Until a better cure is found nothing less should be accepted as a standard or routine. A failure on the part of any one should be considered as much a criminal neglect on his part as a failure to use the ordinary necessary aseptic precautions.

In this symposium Dr. Daniel Fiske gave the statistics of Harrison-Cripps cases to show how absurd it was to talk about carcinoma of the rectum as a benign condition, which are as follows: "He saw four hundred and forty-five patients and operated upon 107. Of those 107 cases 17 per cent. died from the effects of the operation, and 40 were alive five years after the operation, that is, 9 per cent. of the total number seen. It would be fair, I am sure, to say that not more than 5 per cent. would be alive at the end of ten years."

In this symposium Dr. Arthur L. Chute states in the following words: "The story of carcinoma of the bladder is most discouraging when we consider the small number of cures that we effect by means of operation." He further states: "There are just enough cases remaining well after operation to allow us to say that cancer of the bladder is not absolutely hopeless and to spur us to renewed effort in hope that when we have a clearer understanding of the condition that our results will be better." Dr.

Chutes adds this: "It has been held that metastasis takes place late in cancer of the bladder. I doubt if this is necessarily so; and I believe that operations cannot in most instances be considered radical, unless we take into account this lymphatic involvement. I believe the condition is probably this: that so long as a growth is confined to the mucous layer of the bladder there is probably no lymphatic involvement; that the moment it invades the deeper layers we have lymphatic involvement."

If it were possible to make an early diagnosis when only the mucous layer of the bladder was involved, it would seem possible that such conditions could be promptly healed by radium and a few results have been reported, but unfortunately these cases are usually diagnosed late and it is more difficult to apply radium to the bladder than to almost any other organ in the body. The danger of setting up an obstinate cystitis is always to be remembered. From studying the lymphatic supply of the pelvic organs it is readily seen how difficult, if not impossible, it is to remove the adjacent glands involved at the time of operation, no difference how radically it is performed. It is usually impossible to remove all the glands affected. The question when operating is, if the glands are affected, where are you going to stop? There is a limit to everything.

A thorough study of this symposium on cancer and metastasis in general shows us why such free thinkers as Bumm, Doederlein, Kelly and other noted gynecologists have adopted the use of modern radiation as a routine method in all their cancer cases at least post-operatively. It is only a question of time until the entire medical profession will come to the same conclusion. The following is Kelly's report in the *Maryland Medical Journal*, July, 1915: "In nearly 30 per cent. of the inoperable cases even the disease has disappeared under efficient radiation with large amounts of radium element. This was true in a group of over two hundred cases treated by Dr. C. F. Burnam and myself. It is a common sight to witness, too, the disappearance of a growth recurring in the vaginal vault after operation. It is a question for the next three years to settle, whether we will continue to operate on any of the group of cases which melt down under our radium therapy. . . . Up to the present radium has been used repeatedly to shrink an inoperable growth down and then to operate radically."

It is not necessary to quote the results of the work which has been done and reported to members of this society. It would be well if our members would refer physicians interested to one of the many articles which have thoroughly reviewed the literature. There is an excellent article by Henry Schmidt in *Surgery, Gynecology and Obstetrics*, January, 1915, which has undoubtedly been read but not considered sufficiently by all the gynecologists. There can be no doubt in regard to the benefits derived from modern radiation if properly given in conjunction with surgery. The probability of explaining one of the causes which are leading to neglect by many in using post radiation is that they usually asked too much of radiation. Too often in the treatment of cancer all we see is the surgical removal of the line of defense, leaving the lymphatic glands of the adjacent tissue which cannot be removed untreated until a marked or clinical recurrence has taken place, but even then the disease is retarded, the pain relieved and the fetid odor diminished in a large percentage of cases and a clinical cure obtained in some cases.

During the last nineteen months, I have had a limited experience with radium in cancer of the uterus. Treating fourteen cases, ten were recurrent and the other four were so far advanced that they were beyond the operable stage. All improved except two, in that the disease was checked, the growth diminished in size, the pain relieved and the offensive odor lessened or entirely checked. Three have been clinically cured, and one, which is still apparently cured, I reported before this society a year ago. In two other cases the disease has nearly all

disappeared. These results are remarkable when you consider all were hopeless as far as any other treatment was concerned, and that four cases were taking heavy doses of morphine when they were referred.

In this connection I will report the following: Mrs. D., age 33, was referred to me by Dr. Werder for a recurrent carcinoma, following a radical operation for carcinoma of the cervix. The recurrence was marked in the vaginal cicatrix and the hemorrhage and discharge were excessive. On account of her age and the rapidity with which the recurrence was growing, she was considered a very unfavorable case. At the first treatment she was given 2,000 milligram hours of radium, and this was repeated four weeks later. Following the first radium treatment she was given radiotherapy over the anterior abdominal wall, back and perineum, the same as the Koenig Gauss method of treating fibroids of the uterus. The same amount of roentgen radiation was given again after the second radium treatment. Four weeks later Dr. Werder examined the patient and stated that he was unable to detect any disease and considered the case clinically cured. She was again given another radium treatment, supplemented by roentgen therapy, as a prophylactic measure.

Mrs. F. was referred by Dr. Gardner, who stated that he saw the case for the first time three weeks prior and that she gave a history of having had hemorrhages for at least two years and at that time she had consulted a physician who told her that the ulceration might be the beginning of cancer. Following this, she had not seen a physician until the pain had become so severe and the discharge so offensive that she consulted Dr. Gardner, who referred her to me for radium treatment. Some of the necrotic tissue was destroyed by cautery, after which she was given 3,000 milligram hours of radium with heavy roentgen treatment as described before. At the end of two months all the cancerous tissue had disappeared except a small area, which entirely disappeared six weeks later. She was given additional prophylactic treatment and is apparently cured, but the time is entirely too short to give any prognosis.

I have not had as good results in the treatment of carcinoma of the rectum or bladder. However, sufficient results were obtained to offer this method of treatment as a palliative measure in the hopelessly inoperable cases and with the possibility of a cure, or at least further increasing the number of cures in conjunction with surgery. Three of the rectal cases were greatly improved and great palliation was obtained. In one advanced case the palliation was remarkable, in that the mass was reduced in size and the patient had normal bowel movements for six months after the radium treatment.

My results in the treatment of malignant growths of the throat with radium, as a whole, have been very gratifying when you consider the hopeless condition of these patients when they were referred. All were far advanced and operation had been refused except, of course, in some of the cases which were treated post-operatively. One case of carcinoma of the tonsil was reported in the *New York Medical Journal,* July, 1915. Another case which was greatly improved and in which all the disease disappeared was given additional treatment, until finally the surrounding tissues broke down, producing an infection of the throat; and while the patient did not recover, I do not believe she died of carcinoma. This case I believe would have done much better by treatment in small divided doses rather than by the heavy massive dose. A case of epithelioma of the inside of the cheek has been apparently cured for nine months. This case responded in a remarkable manner and the ulceration healed, leaving very little deformity. An epithelioma of the palate showed marked improvement at first, but later broke down and did not respond to further treatment. I might cite a number of cases treated, but the few mentioned briefly will suffice to illustrate my points in this paper.

The cases of epithelioma of the tongue which I have treated were all advanced cases with the usual involvement of the sublingual glands as well as with deeper metastases. While encouraging results were obtained, i. e., the local lesion decreased in size and the metastases checked in nearly all, in only one case did the local lesion entirely disappear. So far I have not treated a favorable case and can speak only of the cases far advanced which were hopelessly inoperable. Cancer of the tongue and buccal membrane are less influenced by radium than cancer in almost any other situation. This is not entirely due to the greater lymphatic supply, with a consequently greater tendency to metastases and the difficulty often in making prolonged applications, but it appears that there is not the same difference between the relation of abnormal and normal tissues. In order to give sufficient radiation to destroy all the cancer cells, greater care must be exercised to avoid injuring the healthy tissue beyond repair. The same caution is not necessary in the treatment of cancer in most other situations. Also the muscles are early infiltrated in epithelioma of the tongue and infiltration of the muscle makes the disease more resistant to radiation. From the experience I have gained in the treatment with radium in such cases the results are better when the treatment is given in divided rather than massive doses. This allows the normal tissue to recover. However, in all cases except epitheliomas situated on the tongue, throat or in the rectum, I would advocate massive doses given as quickly as possible. Then it naturally follows if this is true that you are unable to give as much radiation and the same comparative curative results cannot be obtained in epithelioma of the tongue.

In epithelioma of the lower lip, radium supplemented by roentgen therapy is a perfectly legitimate method of treatment, provided the cases are selected by an expert and the operator is qualified. I believe this will give equally as good if not better results than the removal of a section of the lower lip with the sublingual glandular tissues. With our present methods of roentgen therapy it is reasonable that the disease in these lymphatics can be eradicated in more cases than can be done by surgery.

At the meeting of this society three years ago at Niagara Falls, I quoted a paragraph from Murphy in regard to epithelioma of the lower lip which I believe will bear repetition. "In a series of cases published, 52 per cent. of the patients who had carcinoma or epithelioma of the lip, without any demonstrable metastasis at the time of operation, died of cancer, and 76 per cent. of the patients who had any demonstrable enlargement of the glands at the time of operation died a cancer death."

In the inoperable epitheliomas of the lower lip the growth can be regularly reduced in size and the pain and discharge diminished and in some cases the disease has entirely disappeared with a fair prospect of a permanent cure. If the lesion is removed by surgery, on account of the great lymphatic supply, all the glands cannot be removed down to the mediastinum, so radiotherapy should be used as a prophylactic measure at least.

It is necessary for the operator to know the relative value of radium and the roentgen rays when combining these two agents. In carcinoma of the uterus, for instance, nothing could be expected from a local application of radium with less than from twenty-five hundred to five thousand milligram hours, using nothing less than 50 milligrams of radium element. Then after a rest of three to five weeks another course of treatment is usually necessary. When roentgen therapy is added it should be given in the same manner and quantity as it is used for the treatment of fibroids. How often both forms of radiation is to be repeated must be determined by the judgment of the radiotherapeutist who must be a clinician, because he cannot be entirely guided by the surgeon who is not familiar with any form of radiation. To secure permanent cures the effect of the radiation must ex-

tend from the primary growth out to the metastasis and the deleterious effect on normal tissues avoided.

DISCUSSION

CHEVALIER JACKSON.—A number of years ago I did many operations for malignant disease about the nose, mouth and fauces. Since narrowing my field of work to endoscopy and laryngeal surgery, I no longer do any operation in the regions just mentioned; but long before narrowing my field of work I had refused to operate upon malignancy because my results had been so bad. The cases were so uniformly subject to fatal recurrence that I did not deem operation justifiable. Therefore, I am in a position most heartily to endorse and welcome the advent of the beautiful work that is being done by Dr. Boggs and other members of this society with the roentgen ray and with radium in the treatment of malignant disease of the nose, mouth and fauces. Now let us consider for a moment malignant disease of the larynx. Nowhere else in the human body has the surgery of malignant disease yielded such brilliant results as in thyrotomy (or laryngofissure) for malignant disease of the larynx, provided the operation is limited strictly to operable cases. In using the word operable no reference is had to the question of the patient surviving the operation. The important question is as to recurrence and any case in which recurrence is likely should be considered an inoperable case. As demonstrated many years ago by Sir Felix Semon, operable cases are those in which the growth is strictly intrinsic and of very limited extent. Semon obtained 85 per cent. of cures by thus limiting his operations. His results have been equaled by Sir St. Clair Thomson, Mr. Tilley, myself and others who have followed in Semon's footsteps in the selection of the case for operation. Unfortunately, however, cancer of the larynx is relatively very rarely discovered early enough to permit of cure by operation, either because there has been no symptom that the patient noticed early or because for some other reason the patient's larynx has not been examined laryngoscopically. The last time that I added up statistics of cases seen by myself in 27 years, I had done only 27 thyrotomies out of 211 cases of laryngeal malignancy. Unfortunately it requires a great deal of courage to say "hands off" and, also unfortunately, the surgeon yields to his natural impulse to give the patient a chance, even though remote, of cure by operation, when dealing with a case like cancer of the larynx which, if left alone, yields 100 per cent. mortality. But these cases that are inoperable should be dealt with by radium and the roentgen ray as advocated by Dr. Boggs.

A DEPARTMENT OF LABORATORY NOTES

BEGINNING with the March issue of the AMERICAN JOURNAL OF ROENTGENOLOGY there will be a Department of Laboratory Notes, edited by Dr. David R. Bowen. In this Department will appear brief items, relative to posture, exposure, accessories, dark-room practice and, perhaps, even points of interpretation. In short, it is hoped to attract a multitude of ideas too brief or too isolated to assume the dignity of a paper and yet of such essential value as to command attention.

Much of this matter will not be new and still more will not be original with the editor who will select it solely for its practical utility. From time to time space will be given for the detailed description of working laboratories, floor-plans, etc.

Material for this Department is solicited and due credit will in all instances be given for matter printed.

DOCTOR ROBERT EMMET AUSTIN

Dr. Robert Emmet Austin died November 13, 1915, at his residence in San Diego, California.

Many will recall the man who came the greatest distance to attend the Society's annual meetings. His quiet demeanor at our meetings was hardly compatible with the energetic career which he was pursuing against odds in Southern California. The health handicap under which Dr. Austin worked almost all of his professional life would probably have dampened the scientific ardor of another.

Dr. Austin was born in Carrollton, Missouri, 1872. He was graduated from the Missouri Medical College at St. Louis, 1897, and practiced medicine in Carrollton, Missouri, until the opening of the Spanish-American War in 1898. Immediately after the war he was transferred to the 10th Cavalry and served four years of active duty in Cuba. He then practiced medicine in Kansas City until 1906 when he took up his residence in San Diego, California.

Dr. Austin led an extremely busy professional and business life in San Diego. He became president of the San Diego County Medical Society and of the Southern California Medical Society. He was at one time president of the San Diego Board of Health. He was at one time vice-president of the American Roentgen Ray Society and was a charter member and first treasurer of the Pacific Coast Roentgen Society.

There are probably but few members of the American Roentgen Ray Society who are familiar with the roentgen activities of Dr. Austin. He has produced a stereoscopic anatomy which is seen illustrated in the accompanying cut. He had erected a building in Spanish Mission style for his roentgen laboratory exclusively. At the time of his death he had almost consummated a plan which would have resulted in at least a ten-story hospital building, with offices on the first floor for twenty-five medical and surgical specialists of his own selection.

Dr. Lyell Kinney, formerly of Los Angeles, has taken over Dr. Austin's laboratory and business. Dr. Kinney is a new member of The American Roentgen Ray Society.

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EDITORIALS

The mid-winter meetings of the Eastern roentgenologists at Atlantic City and the mid-winter meeting of the Western roentgenologists in Detroit have proved conclusively that these sessions have a distinct place in the annual program of the Society as the attendance at both was such as to warrant their continuance. The educational value certainly compares favorably with that derived from more formal annual meetings. There has been a sentiment favorable for the creation of an eastern section, a middle section and a western section. This would necessitate a change in the constitution and would permit of the executive committee having control. We hasten to add that this proposal has not had its origin in any criticism of the conduct of the meetings, as all comments have been extremely favorable.

* * *

The medical pendulum which swings in regular beats, accentuating the extremes of one side with the extremes of the other, has had a wide swing lately in some of the recent developments in roentgenology. Not many months ago we were told that the proper technique for deep roentgen therapy of the uterus and its appendages consisted in marking off the abdomen into little checkerboard divisions and selecting as many points of entry as possible. We recently had the pleasure of conversing with a gentleman who had just returned from Freiberg. He tells us that the technique above mentioned has been abandoned in Freiberg and that the patient is now prepared by a twilight sleep for one long séance of six hours given through one general port of entry through the abdominal wall. The results by this newer technique are claimed to be much better than by the former procedure. We shall wait with eagerness the published case reports of cases treated by this newer technique.

In looking through some of the recent numbers of the *Index Medicus,* we note that the subject of Roentgenology is not given as a subdivision. We are glad to find, how-

ever, in the directory of the American Medical Association that Roentgenology is now listed as a recognized specialty. We would respectfully suggest to the editors of the *Index Medicus* that they give Roentgenology a proper division, so that their readers will be kept informed as to the new articles appearing on the subject of Roentgenology.

* * *

The Second Annual Mid-Winter Meeting of Roentgenologists was held at the Hotel Chalfonte in Atlantic City, January 21 and 22, 1916.

The attendance was approximately eighty-five, or about the same as last year, and at least seventy-five were present for all four sessions.

With only slight changes, as to order, the plan as printed in the December AMERICAN JOURNAL OF ROENTGENOLOGY was followed.

Dr. Johnston was unavoidably absent and Dr. Baetjer was chosen chairman for the first session (Friday evening).

Roentgen therapy and its adjuvants was discussed by Drs. Pancoast, Stern, MacKee, and Pfahler. The dominant point developed was the need of a definite standard of measurement of dosage. It is to-day much easier for an operator to set up a standard which gives him results with his own equipment than it is to put that standard into words which will convey that meaning to another. This discussion occupied the entire evening.

On Saturday morning the first topic was "Workingmen's Compensation Laws as Related to Roentgenologists," discussed by Drs. Eastmond and Chas. F. Bowen. If this thing is troubling you, let us refer you to Dr. Bowen. He evidently "knows how."

"Progress and Prophecy," discussed by Drs. Coolidge and Caldwell and Mr. Snook, proved all that might be expected. Standardization, high-tension transmission, and water-cooled Coolidge tubes, of fabulous capacity were all attractively pictured. Dr. Caldwell claims to find prophecy an easier topic than progress, but he produced "good listening" on both sides. An "unlisted attraction" was the entertaining chapter on history by Dr. Goodspeed of the University of Pennsylvania. It was most difficult to realize, as he talked of his own pioneer work, that he was referring to no happening of more than twenty years ago.

Easily the most absorbing topic and, in some lights, the most controversial, was "Pulmonary Tuberculosis: What Is the Present Value of the Roentgen Ray in Its Diagnosis?" Drs. Daland, Cole, Holmes, Heise, Manges and others. This was Dr. Heise's first appearance among us and seldom has a demonstration attracted more interest. We predict that Saranac is hereafter to be no less a Mecca for roentgenologists than for other students of tuberculosis. The main lesson of the discussion was the paramount need for joint study, by clinician and roentgenologist. The discussion extended well into the afternoon.

The discussion of bone diseases by Drs. Albee, Baetjer, LeWald, Jaches, and Hammond went far to demonstrate that there is still room for good constructive work in what we are often apt to consider an elementary field.

"Gall Stones," discussed by Drs. George, Pfahler and Selby. (A paper by Dr. Case was in his absence abstracted and read.) The discussion was largely statistical and shows a marked tendency to become less controversial.

On Saturday evening lantern slides "too numerous to mention" gave a fitting termination to the meeting.

The spirit of the meeting—informal discussion of recent progress without unnecessary controversy—was even better observed than in the meeting of last year. Perhaps it is not permissible to criticise the informality of an informal meeting, none the less we believe that next year it may be well to remember that few practical workers are accomplished speakers and that even the most accomplished rarely do their best if frequently interrupted. In a meeting of this kind the utmost freedom as to questions should be allowed, but for two very good

reasons the questions should be withheld until the speaker has finished. First, an important thought interrupted may remain undeveloped and, for that occasion at least, lost to the audience; second, the deferred question so often proves to be needless, its answer having been naturally developed by the speaker.

But we are of those who learn by doing and there seems to be a happy future for the informal "mid-winter" along lines already becoming a habit.

As a result of this session we venture to hope that the AMERICAN JOURNAL OF ROENTGENOLOGY may be permitted to publish papers by Drs. Daland, Heise, Holmes, Chas. F. Bowen, Goodspeed, Albee, MacKee, Baetjer, and Case, all of whom either read papers or presented discussion with abundant material for papers. It also seems not too much to expect that the stimulus received may produce others not so apparent at the time.

All this is quite compatible with the resolution adopted that no part of the discussion be printed except by permission of individual speakers.

SOCIETY PROCEEDINGS

THE PACIFIC COAST ROENTGEN SOCIETY

A semi-annual meeting of the Pacific Coast Roentgen Ray Society was held upon December 11 and 12, 1915, at the Plaza Hotel, San Francisco, California. The meeting was attended by all of the members of this new Society and the meeting proved very successful from every standpoint.

Dr. W. W. Boardman, of San Francisco, gave a comprehensive presentation of bone tumors, illustrated by many interesting lantern slides.

Dr. Albert Soiland, of Los Angeles, read a paper on the cancer problem in the female breast with reference to roentgen ray supplemental treatment.

Dr. George L. Painter, of San Francisco, presented an interesting paper illustrated by lantern slides on radiography of the teeth and alveolar processes and its use in dentistry.

Dr. H. H. Ruggles, of San Francisco, showed some interesting roentgenograms and slides on obscure chest and gastro-intestinal lesions together with case histories of same. Dr. William B. Bowman, of Los Angeles, read a paper on the use of the roentgen ray as a therapeutic agent with special reference to deep-seated lesions.

This Society was organized at the time of the American Medical Association meeting in San Francisco, and it is the ambition of this new Society to include within its membership all of the good roentgenologists upon the Coast. The membership of the Society is also open to any graduate physician in reputable standing in his community who can qualify for membership in the American Roentgen Ray Society. In other words, the requirements for membership in the Pacific Coast Roentgen Society are about the same as the requirements in the American Roentgen Ray Society. The next meeting of this Society will be held in San Diego, California, sometime in June, at which time they will be the guests of Dr. Kinney, who has just taken over the laboratory practice of the late Dr. Emmet Austin.

NOTICE

The Executive Committee wishes to announce that the next annual meeting of the American Roentgen Ray Society will be held in Chicago. Date and hotel have not yet been selected.

DEPARTMENT OF TRANSLATIONS AND ABSTRACTS

EDITOR, JAMES T. CASE, M.D., BATTLE CREEK, MICH.

The Roentgentherapy of Myomata in One Séance. **Friedrich, W., and Krönig, B. (München. med. Wchnschr., Dec. 7, 1915, Vol. LXII, No. 49, p. 1669.)**

The authors report the result of their new method of treatment in 75 cases, of which 40 have reached the stage of amenorrhœa. In the remaining 35 the period in which amenorrhœa usually occurs had not yet completely elapsed. They have discarded the Kienböck strips, and use the Iontoquantimeter which is introduced into the rectum so high that the center of this iontinization chamber lies as near as possible to the ovaries. This enables them to speak of a definite ovarian dose which produces amenorrhœa, analogous to the erythema dose on the skin.

To obtain this in one session with possibly only one portal of entry two conditions had to be fulfilled:

1. Rays had to be selected so one can secure a sufficiently favorable quotient of dosage between skin and ovary, and

2. A method had to be devised which permits bringing both ovaries into the center of the cone of rays.

To determine the second, a lead marker is affixed to the center of the skin area and then by means of the fluoroscope the marker and the iontinization chamber are brought within the central ray.

The first condition was fulfilled by filtering the rays from a Coolidge tube through 1 mm. copper, instead of 3 mm. of aluminum, and thus obtaining much harder rays.

The authors have used a Coolidge tube backing up a 40 cm. equivalent spark, with a 5 cm. spark gap in front of the tube, and a filter of 1 mm. copper. The great advantage of this tube was found in the fact that notwithstanding this strong filtering, the rays passing through the filter were yet so intense that the necessary ovarian dose, irradiating only one skin area, was reached in about three hours.

The authors have applied this method also in cases of carcinoma but are not ready to draw any conclusions.

L. J.

Therapy of Inoperable Gastric and Intestinal Carcinomata by Incision and Subsequent Roentgen Irradiation. **By Privatdozent Dr. Hans Finsterer. Strahlentherapie, VI, 205. (From the Surgical Clinic of Hofrat Hochenegg in Vienna.)**

The value of any method of therapy can be tested with moderate certainty only when all observations made regarding the method are reported, so that the opportunity is offered to point out certain advantages, and above all, also the disadvantages.

In a brief report published in the *München. med. Wchnschr.*, 1913, I described more accurately my method of exposing by laparotomy gastric carcinomata, emphasized its advantages over the procedures in use till then and reported several cases which were favorably influenced by roentgen irradiation after incision. Since then this method was practiced at the clinic in twelve additional cases, on which a few important observations were made. These deserve publication because under certain circumstances they can define the limitations of this method.

The technique of the incision remains in its essentials identical with the procedure already described. It is as follows: Median laparatomy is performed under local anæsthesia, the inoperability of the tumor determined in every case, and then, even though there is no evidence of pyloric stenosis, posterior gastroenterostomy is performed; the transverse colon is replaced, then both recti

The Abstract Editor is indebted to the Zentralblatt für Röntgenstrahlen, Radium und verwandte Gebiete for material aid in the production of abstracts of many of the foreign articles.

muscles are cut transversely all the way across to the costal arch, about three fingers' breadth above the umbilicus. This causes a large rhombic defect in the anterior abdominal wall in which the diseased stomach, which remains completely in situ, is exposed to view. In order to produce adhesions the abdominal cavity is walled off by strips of iodoform gauze; the liver is fixed to the costal arch so that it should not cover the exposed stomach. Lately I have discarded the use of iodoform gauze because it cannot be sterilized and is consequently somewhat unsafe in the abdominal cavity. Instead I have used plain sterile gauze which did the same service.

There is no doubt that by this radical method even extensive carcinomata of the stomach can be completely exposed, especially when they arise from the prepyloric area and have become inoperable by involving the ligamentum hepato-duodenale and the transverse colon, and by having given rise to metastases. Experience has shown that after this exposure even carcinomata of the cardia can yet be influenced favorably; but it is evident that the hidden position of the tumor diminishes its accessibility for the rays as a result of the scar formation which commences in the margin.

In my first report I could state from the strength of my experience that I had not seen any immediate or later disadvantages from the extensive cross section of both recti muscles. With reference to the later disadvantages, this is still true to-day because all cases have proven that the large defect in the anterior abdominal wall has caused the patient no unusual inconvenience after it had healed. The diminution of the defect occurred rapidly, partly by contraction of the scar in the muscles, partly by epithelialization of the protruding stomach; in fact, it was more rapid than was compatible with treatment of long duration. The patients were able to leave their beds with an abdominal binder during the third week and became completely able to work after several months.

The danger of peritonitis as well as of prolapse of intestinal loops can be eliminated by exact tamponing. The only case of peritonitis occurred in a case of infection which was undoubtedly caused by the non-sterile iodoform gauze, because local pus formation occurred in the region between the stomach and the spleen, where the iodoform gauze strip lay.

A disadvantage of the cutting of the recti muscles, which should not be underestimated, is the diminished ability of the patient to expectorate. Though local anæsthesia materially decreases the dangers of lung complications, they cannot be entirely eliminated in those cases in which chronic bronchitis and emphysema existed already before the operation, and in which as a consequence of the cessation of expectoration there occurs congestion of secretions which is followed by lobular pneumonia. This congestion of secretions will occur all the more readily when coughing is not only painful but also made difficult by the section of the recti muscles, which is especially important in cases of advanced cachexia. As a matter of fact there are among the last twelve cases four in which the patient died of lobular pneumonia.

It therefore follows that it is better to omit the section of both recti muscles, and with it altogether the exposure of the stomach, in cases of chronic pulmonary disease in which there is also advanced cachexia, because here the method may be directly harmful. We can do this all the more because recent experience has shown that even without exposure of the tumor, considerable success can be obtained by efficient deep therapy.

Starting from the assumption that by extensive exposure of the stomach, not only its peristalsis may be disturbed, but also that a permanent duodenal stenosis can be caused by the tamponing, I proposed to perform gastroenterostomy in every case even in the absence of pyloric stenosis. Where this was not possible because of the extent of the tumor, jejunostomy ought to

be performed. The expediency of this proposition was demonstrated already in the succeeding cases because of the quicker and more sufficient nutrition. To be sure, further observations have shown that even the exposed stomach, which eventually becomes epithelialized and supplants the anterior abdominal wall, will resume its normal peristalsis, so that the patient is again able without difficulty to take nourishment by mouth. The jejunostomy can then be permitted to close spontaneously after removal of the tube. Nevertheless I would recommend the performance of jejunostomy in every case, at least for the beginning; it does not make the slightest complication, provided that it is performed with the proper technique.

The successes which were obtained with roentgen irradiation following surgery were in the beginning very favorable, so that one could contemplate with some degree of hope the treatment of these otherwise hopeless cases. If the subsequent course was not so favorable, I must emphasize my conviction that the roentgen irradiation was not sufficiently intensive in all cases. This we are taught especially by the comparison with the doses of deep therapy in use lately, which are incomparably higher, even considering the filtration. Though it is true that after exposing the carcinoma smaller doses ought to suffice to influence the tumor which is being irradiated directly, like a cutaneous carcinoma; and though on the other hand by initial large doses the necrotizing effect preponderates and the danger of perforation and the formation of gastric fistulæ exists, there is no contraindication to a rapid increase of the dosage in subsequent treatment. In this manner we can not only effectively irradiate deep-seated parts of the tumor and retroperitoneal glands, while at the same time the exposed anterior gastric wall can be protected by filters just as the skin in ordinary roentgentherapy, but we can also influence favorably the less accessible places (cardia) analogous to the ordinary deep therapy.

But inasmuch as this form of deep roentgentherapy requires special apparatus and itself consumes much time, and because it is also more in the interest of science and better for the patient if such irradiations are carried out in certain central places, it is highly laudable that such deep therapy be done in the central roentgen Institute of Prof. Holzknecht, under the direction of the same physician (Dr. Sgarlitzer), where we shall also send for treatment our subsequent cases of exposure of the stomach.

It is absolutely necessary to report the result of those cases which in my first communication could be designated as having been favorably influenced by roentgentherapy, because only after observations extending over a considerable period of time can the value of the method be determined.

In the first case the treatment resulted in a marked prolonging of life; for, in the case of a carcinoma extending from pylorus to esophagus, the term of life after gastroenterostomy alone amounts to hardly more than three months, according to the experience gathered by me in such cases. In this case the patient gained 30 pounds and was in good health for 1¼ years; only after the lapse of that time there was again loss of weight, and then metastases in the liver became clinically certain. The patient died 21 months after the exposure. It must be noted that in this case the roentgen doses were relatively small (12 H in nine sessions), and that the treatment was not carried on sufficiently long, because the patient simply did not present himself for treatment.

In the third case the patient was a 50-year-old woman who had carcinoma of the prepyloric area of the stomach which extended to the duodenum and to the ligamentum hepato-duodenale and which invaded the transverse mesocolon. After the irradiation the patient gained 24 pounds in weight and the tumor disappeared completely. The patient could be presented as improved in May, 1913 (total dose 47 H). The woman did not present herself for any more treatments after April, 1913, in spite

of repeated requests to do so. In February, 1914, when she appeared for examination, her appearance was good and she had gained 28 pounds, after which the weight remained the same for about a year. The clinical examination, however, again showed a tumor of the anterior gastric wall somewhat larger than a walnut, which owing to the defect of the abdominal muscles could be grasped in this situation from behind and was freely movable. Intensive deep therapy (12 H) was given by Dr. Sgarlitzer in the roentgen institute of Prof. Holzknecht, and eight days later a radical operation was proposed to the patient. The laparotomy performed under local anæsthesia was somewhat difficult owing to the adhesions which had been artificially produced; nevertheless the resection of the entire pyloric area, which was slightly adherent to the liver, was easily performed. Thus in this case the formerly inoperable carcinoma of the prepyloric portion had been made to retrogress so far that it had become operable after the lapse of a year. After resection of the pylorus, and leaving the gastroenterostomy intact, prompt healing occurred. It remains questionable, however, whether the resection should be considered a radical operation, for a dense band which extended deep into the subhepatic region had to be left there partly. For this reason the patient is being subjected to further deep roentgentherapy.

In case 4 the woman had markedly recuperated after the exposure; the tumor was no longer palpable. There followed more roentgen irradiations with relatively small doses (total quantity 47 H). A roentgen ulcer forming in March, 1913, at the granulating surface in the center of the projecting stomach, roentgentherapy was discontinued and the ulcer treated with radium (eight irradiations of an hour each with 18 mg.); but the ulcer became deeper and deeper. At the end of April it perforated and a gastric fistula formed. The patient was then again admitted to the clinic. An unsuccessful attempt was made to close the fistula, but the patient sank rapidly and died August 22nd, 1913. This is the only case of gastric fistula after exposure of the stomach.

In case 7 the patient, a 46-year-old man, had completely recuperated, the cachexia had completely disappeared and he had again become able to work. The exposed stomach had epithelialized. The irradiation was continued at intervals of one month (altogether 60 H), the last irradiation having been given at the end of June, 1913. At that time his complexion was good, there was no sign of cachexia, no tumor palpable, his health was good. Later we were informed by letter that the patient was working as a farmer. During the harvest he caught cold, and developed acute pneumonia to which he succumbed in a few days. Unfortunately no autopsy could be had in this very important case because the patient died in the country.

Out of twelve more cases of exposure of the stomach a temporary success was obtained in three. A 61-year-old woman with an inoperable carcinoma of the prepyloric area recuperated markedly for a short time after the performance of a gastroenterostomy and the exposure of the tumor on February 17th, 1913. She gained twenty-six pounds in weight, the exposed tumor disappeared completely; and the defect was very quickly covered by epithelium and was reduced in size. After a period of good health lasting nine months her condition became worse, new tumors appeared at the site of the exposure, and when they involved the anastomosis, she began to vomit. The patient died from cachexia due to carcinoma twelve months after the operation. The total roentgen dosage employed was 40 H.

In the case of a 53-year-old man who had been suffering for four months from increasing difficulty in swallowing, and finally could take only fluid nourishment, the roentgen examination revealed carcinoma of the cardia. Laparotomy, performed May 6th, 1913, showed a carcinoma, about the size of a man's fist, which was situated in the fundus of the stomach and had extended

into the esophagus. There was also an extension into the vertebral column. Jejunostomy and exposure of the stomach was accomplished, and the patient subjected to roentgen irradiation. After three months there was remarkable improvement (total dosage 30 H). The patient was again able to eat everything, also to swallow solid food, so that it was no longer necessary to feed through the fistula. After two more months, the additional weight amounted to fourteen pounds, and the patient looked well. Soon after there recurred an increase of the difficulty of swallowing, with progressive cachexia. In spite of further roentgen irradiation (additional 20 H) he died seven months later at his home.

In the case of a 66-year-old lady who had an annular carcinoma of the pars media of the stomach which extended into the esophagus and retroperitoneal glands adherent to the aorta, exposure of the stomach with simultaneous jejunostomy was performed on March 14th, 1913. At first she was fed through the fistula exclusively, and irradiation was administered every fourth day. There were increasing improvement in her general condition and diminution of the tumor. After four weeks feeding per os was resumed. The fistula soon closed altogether, permitting the patient to feed exclusively from above. In the beginning there were gain in weight and continuance of good appetite. Roentgen irradiation (total dose 44 H) was continued until summer. Patient then stayed away. In the fall in response to a request she again appeared at the clinic. At that time she was emaciated, the tumor had again grown larger and was distinctly palpable. Exitus eight months after the operation.

From the reported cases the conclusion may be drawn that exposure of the gastric carcinoma followed by roentgen irradiation will result in temporary success in a few cases, inasmuch as not only is the growth of the tumor retarded and the general condition improved, but also the tumor can be made to diminish in size. Nevertheless it is our duty not to limit the indications for the resection, but on the contrary, we must, if possible, extend the indications for resection.

It has been frequently asserted that by radium irradiation inoperable carcinomata, e.g., of the uterus, have again become operable. With roentgen irradiation we have observed it in the above-mentioned case No. 3. Even though the histological examination did not show that the extirpated gland, which was found at a distance from the tumor, contained carcinoma, the clinical diagnosis was beyond all doubt, and its correctness was demonstrated absolutely by the continued growth of the carcinoma which had at first decreased in size. The case is instructive in two respects, because it shows first, that a carcinoma can so far diminish in size that an operation again becomes possible; secondly, that roentgen irradiation must be continued for a long time in order to prevent a further development of the carcinoma, a demand made by many radiologists. For in our case the carcinoma manifested itself by the formation of a small tumor in the exposed part of the stomach after the lapse of about a year since the last roentgen irradiation.

The following must be borne in mind: Great demands are made upon the general health of the patient by an intensive roentgen irradiation; on the one hand it is the irradiation itself; on the other it is the absorption of the products of destruction of the decreasing carcinoma which play the main rôle. This suggests that, in order to eliminate as far as possible the absorption of the products of destruction, the primary focus of disease must be removed together with the accessible glands, though without hope of an absolutely radical operation; and this is to be followed by a secondary roentgen irradiation on account of the remaining focus which is probably only microscopic. I have adhered to this standpoint systematically for more than a year at the Hochenegg Clinic and have resected even cases of gastric carcinoma which heretofore have gen-

erally been considered inoperable. This has been quite feasible without increase of the operative mortality by substituting local for general anæsthesia. I have then referred all resected cases for deep roentgen irradiation. A primary exposure of the entire operating field is not permissible because of the poor prospect for healing of the gastro-abdominal sutures where the abdominal cavity is open. For that reason I have proposed in a previous communication to expose the operating field by a secondary laparotomy. Owing to the modern development of the technic of deep roentgentherapy, this secondary exposure will probably always be avoided in the case of such small remnants of the carcinoma.

While, in the case of gastric carcinoma, the total exclusion of the diseased organ is technically as difficult as the resection, it is possible in inoperable carcinoma of the colon to accomplish total exclusion successfully either by simple colostomy (in carcinoma of the flexure) or by the typical bilateral exclusion of the colon according to Hochenegg (in carcinoma of the cæcum). One is then enabled to expose freely the entire focus of disease and, without disturbing the passage through the colon, to submit it to energetic roentgen irradiation in the manner of the superficial carcinomata. Until now, to be sure, I have not been able to expose in this manner inoperable carcinomata of the cæcum, because these cases are amenable to radical operation even when the tumor is very large. Only in one case, a man of 43, who had carcinoma of the sigmoid flexure, which was inoperable because of fixation to the spinal column and the aorta, I performed in May, 1913, the exposure for the roentgen irradiation. The descending colon, which had been affixed to the abdominal wall for the purpose of a lateral colostomy, was not opened, because movement of the bowels was not interfered with. This is completely analogous to my experience with exposure of gastric carcinomata, inasmuch as by the exposure itself peristaltic activity was not disturbed. Nevertheless I believe that it would have been better even in this case to turn away permanently the fæces from the diseased area by means of a fistula. The success of the irradiation was at first very striking: gain in weight; increased appetite; no blood in the stools as before the operation. The man is still alive (one year and four months after the operation), but the tumor seems to have grown again, because lately symptoms of stenosis have reappeared, which may, however, be ascribed also to adhesions caused by the operation. The appearance of the patient, who for a long time has been a morphinist, is still good.

Judging from our present experience, we can ascribe to roentgentherapy after exposure of the tumor only a palliative effect; it is justified in inoperable tumor, especially when for social reasons a short prolongation of life is important. As a combined method of treatment, i.e., as after treatment after resection of carcinomata which are on the border line of operability, this method will achieve great importance, judging from experience to date, so that surgeons and radiologists will perhaps by joint labor achieve better results in combating carcinoma than was possible until now for the surgeon alone.

(Translated by L. JACHES, M.D.)

Radium Therapy in Dentistry **(Radiumtherapie in der Zahnheilkunde). M. Levy. Strahlentherap., 1914, iv, 123.**

Radium treatment in dentistry may be applied in two ways: either by local application of solid radium salts, or by local or internal applications of emanations. Malignant tumors of the mucous membrane of the mouth are quite frequently refractory, or may even grow worse. Good results are sometimes obtained in inflammatory processes of the mucous membrane of the mouth and jaw, in pyorrhœa alveolaris, acute and chronic pulpitis, as an analgesic in sensitive dentine, and also in epulides, leucoplakia, aphthous stomatitis and desquamation of the mucous membrane. The author has given short ir-

radiations with tubes and longer irradiations with radium compresses. He has had good results with these in local inflammatory processes, marginal gingivitis, stomatitis, epulis, ulcers, and leukoplakia of the tongue, less favorable ones in pyorrhœa alveolaris. In the last condition the emanation treatment is best because of its stronger bactericidal effect and its specific effect on the body ferments. Radium emanations as well as thorium emanations in the form of thorium *x* can be used. It is used in the form of douches, which produce hyperæmia of the mucous membrane and also activation of the saliva. Treatment may also be given in the form of irrigations, injections, insertion of radium carriers in the pockets of the gums, and massage with radium plates. These methods have given very satisfactory results in psoriasis of the mucous membrane, gingivitis, stomatitis, pyorrhœa alveolaris, leukoplakia of the mouth, fistulas of the teeth, acute suppuration following infection and infected extraction wounds. Pyorrhœa alveolaris is very frequently the result of a constitutional process. The author calls especial attention to the fact that a latent gout can often be demonstrated by uric acid examination of the blood. Therefore, a drink or inhalation treatment with emanations is to be recommended in conjunction with general treatment.

Effect of Radium on Tumors of the Spleen **(Ueber die Wirkung von Radium auf Milztumoren). H. Schüller. Berl. klin. Wchnschr., 1914, li, 293.**

Tumors of the spleen and glands in leukemia and similar diseases undergo marked retrogression under radium irradiation, with simultaneous improvement in the blood picture and general condition. Some tumors seem to react well to radium that do not react at all to roentgen rays or have ceased to do so. Especially striking is the effect on the spleen in Banti's disease. The effect persists for several weeks after the treatment, both with reference to the decrease in size of the tumor and the improvement of the blood picture. The author cannot report as to permanent results, because his cases have been under observation too short a time; but he thinks a good deal of skepticism should prevail. No injuries of the skin or peritoneum were observed. Splenectomy was not made more difficult by preceding irradiation. It is possible to first decrease the size of the spleen by previous irradiation, and thus make splenectomy easier, or even make it possible in cases where it was impossible before.

Effect of Radioactive Substances on Mouse Cancer **(Analyse der Wirkung radioaktiver Substanzen auf Mäusekrebs). A. Von Wassermann. Deutsch. med. Wchnschr., 1914, xl, 524.**

The important question is whether the rays act directly on the tumor or whether they act indirectly through the blood or other cells. From his animal experiments the author concludes that radioactive substances act directly on the cancer cells; they do not kill them, but they prevent their further increase by acting on their capacity for division or reproduction. The sterile cells are then killed by the normal bactericidal forces of the body. The following may be stated as the law for the elective effect of radioactive substances on the different tissues of the body: the more capacity a cell has for proliferation and regeneration, the more sensitive it is to radioactive rays.

Injuries to Workers with Radioactive Substances **(Ueber berufliche Schädigungen durch radioaktive Substanzen). F. Gudzent and L. Halberstaedter. Deutsch. med. Wchnschr., 1914, xl, 398.**

The authors report 12 cases of men who suffered injury from greater or less periods of working with radioactive substances. These are divided into two groups: (a) general disturbances and (b) skin injuries. Besides the alteration in the function of the

sexual glands, there was a change in the blood picture. There was always an absolute, as well as a relative, lymphocytosis; the number of red cells was not very much changed, and the number of white cells was slightly decreased; it was under 7,000, the lowest number being 5,500. The hemoglobin content was decreased in only one case. The chief change in the skin was a hyperkeratosis; the skin became smoother and looked like parchment or leather. There was a dirty-looking layer of horny substance deposited around the edges of the nails and under them; the skin was stippled in places and rhagades appeared. In severe cases the nails were brittle and loosened more or less at the apex from their bed, and in some cases deformed. The authors warn radiologists to beware, and give rules for avoiding the skin injuries as well as the general disturbances. Care should be taken to have frequent and thorough airings of the work room to remove emanations; to protect the body against too intensive irradiation by covering the work table with metal; to give short hours of work and frequent change of employment to recover from the effects. Frequent medical examinations should be made and the blood examined at least twice a year.

Theory of Action of Rays, Especially with Reference to Latency (Zur Theorie der Strahlenwirkung, insbesondere über die Latenzzeit). H. Heineke. München. med. Wchnschr., 1914, lxi, 807.

Heineke says that the period of latency in roentgen treatment is explained by the lapse of time between the destruction of the cell's capacity to reproduce and the natural death of the irradiated cell. Experiments by Hertwig, Halberstadter and von Wassermann, demonstrating the capacity of the rays to annihilate the cell's capacity for division without killing it, give the long-sought-for explanation of the latent period in irradiation. The effect on the irradiated cell only becomes manifest after the lapse of the cell's natural life. In addition to this sterilization of the cell, higher dosages of rays also cause a direct injury of the cell which hastens their death. In the highly sensitive normal and pathological cells, whose reaction begins without any period of latency, and is exhausted within a few hours, only signs of direct destruction of the nuclei are demonstrable. From this we must conclude that the nature of the action of the rays is essentially different in these cells from what it is in the slowly reacting ones. The tumor cells react to the rays in about the same way as the normal mother cells from which they originate.

Present Status, Problems and Limitations of Radiotherapy of Cancer (Heutiger Stand, Probleme und Grenzen der Strahlenbehandlung des Krebses). Ernst Von Seuffert. Strahlentherap., 1914, iv, 740.

Seuffert holds that radiotherapy is to be preferred to operation in all cases, because the permanent results are just as good as those in surgery, while there is a primary mortality of 10 to 25 per cent. in surgical treatment, and practically no mortality in radiotherapy. The greatest problem in the further development of radiotherapy is improvement in the knowledge of dosage, and great advances have recently been made in this field, especially with reference to roentgen rays. Radium, mesothorium and roentgen rays are of about equal value in radiotherapy. Radiotherapy also has its limitations if the pathological process is too extensive. In internal tumors it may well be preceded by surgical intervention to make the tumor accessible to the rays. The possibility of obtaining harder rays is one of the important recent advances in roentgen treatment. The biological effect of the rays on the skin, however, is not entirely dependent on their hardness, but may be very different with different forms of apparatus, and must be determined by experiment. The amount of the minimum dose for therapeutic effect

must be determined by the sensitiveness of the tissues to be treated, and this varies greatly. Danger to the skin in many cases prevents deep irradiation through the skin; great caution should be exercised in constitutional diseases and in acquired local hypersensitiveness; there is danger of injury on repeated irradiation of spots that have previously been exposed to roentgen rays. Care is necessary also in very young individuals. The younger the cell the greater its sensitiveness; this is true of both normal and pathological cells. The effect is due to the rays themselves and not, as might be assumed, to substances produced in the body by the rays. The soft, or alpha and beta rays, have not the specific elective effect of the hard rays, but they seem to exercise a more uniformly corrosive effect on all the tissues. There is still some doubt as to whether the biological effect is produced by the primary hard, or gamma rays, or by their secondary rays. Still more doubtful is the value of attempts to inject various substances to supplement the destruction of the carcinoma cells.

Pulmonary Physical Signs and Roentgen-Ray Findings in Healthy Adults. **Louis Hamman, M.D., and F. H. Baetjer, M.D., Baltimore, Md. (The Archives of Internal Medicine, November 15, 1914.)**

For the purpose of their study, Hamman and Baetjer selected fifty students and physicians who, as far as symptoms go, were in perfect health. A minute examination was made of the chest by Hamman, and the results of inspection, palpation, percussion and auscultation were recorded and the deduction made therefrom as to the condition of the lungs committed to writing. A roentgenogram was then finished and reported on in writing by Baetjer, who had no knowledge of the outcome of the physical examination. Finally, the results of the physical examination and of the roentgen-ray examination were compared.

In reading the roentgen-ray plates the following points were noted:

1. The density of the hilus shadow, which is recorded as normal, slightly increased, moderately increased or markedly increased.

2. The number and position of gland shadows.

3. The bronchial tree shadow (which includes bronchi, vessels and connective tissue), which is recorded as normal, slightly increased, moderately increased or markedly increased, and differences in various locations described.

4. The density of the lung substance itself. Special attention was given the condition of the apices and, indeed, abnormalities were limited mostly to the apices. On roentgen-ray examination, the normal lung apices are clear and the apical spaces are equal on the two sides. The earliest change occurring at the apices is invasion by fine radiating lines extending from the bronchial tree, subdivisions which become visible only as the result of inflammatory changes. Following this the whole apical region becomes a little cloudy and opaque, probably due in large part to pleural changes. Finally, contraction may occur, which is early evidenced by narrowing of the space between the first and second ribs.

Regarding the roentgen ray findings as a control of the physical examination, the fourth point alone comes into consideration. Mediastinal shadows, though dense, give no physical sign. Glands enlarged sufficiently to cast definite shadows to roentgen ray illumination are still quite beyond the reach of percussion and auscultation. Increased density of the bronchial tree is discoverable only when the increase is unusually marked and extends close to the surface of the lungs in the region of the apices.

Reviewing the results of the physical examination, it was found that of the fifty healthy adults examined, in eleven the lungs are recorded as practically normal; that is, in only five the note was made that absolutely no abnormality was found; in the re-

maining six very slight changes in the physical signs were discovered, but the changes were so slight that they were considered questionable. The five perfectly normal cases all had roentgen ray examinations. In three the note was made: "Perhaps slight clouding at the right apex, but practically normal;" one showed very slight clouding at both apices; one, slight clouding and retraction at the left apex.

Of the six practically normal chests with slight, questionable physical signs, five had roentgen ray examinations. In all five, physical examination indicated slight changes at the right apex, whereas roentgen ray examination showed normal lungs in one instance, slight changes at the left apex in three, and slight changes at the right in one.

Of the fifty examinations, in eighteen definite abnormalities were found at the right apex; in fifteen, though definite, the abnormalities were slight; in three they were well marked. Of the fifteen with slight though definite changes in the physical signs, the roentgen ray results accorded in detail with the physical examination in seven instances; in two instances slight changes were found at the left apex as well as at the right; in three the right apex was found clear, though there was a little clouding at the left apex; in two no definite changes were discovered in the lung; one had no roentgen ray examination.

Of the three instances with more marked abnormalities at the right apex, two had roentgen ray examinations. In one the roentgen ray and physical examinations agree in detail; in the other the roentgen ray reveals a slight lesion on the left, besides the more marked change at the right.

Twelve of the fifty examinations showed definite changes in the physical signs at the left apex; in eight instances the changes, though definite, were not marked; in four they were well marked. In the eight instances with definite though slight changes, the roentgen ray examination agrees accurately with the physical examination in three; in four it reveals a slight lesion at the right as well as left; in one the left apex is found clear, the right a little cloudy.

In the four instances of more marked changes at the left apex the roentgen ray examination agrees accurately, except that in one slight clouding is present as well at the right.

In nine of the fifty cases there were abnormalities in the physical signs at both apices; in six the changes were definite though slight; in three very well marked. In the six with slight changes the roentgen ray and physical examinations coincide in three; whereas, in the remaining three, the roentgen ray showed changes at the left apex alone. Of the three with well marked changes, two had roentgen ray examinations, and in both they correspond accurately with the results of physical examination. These two individuals showed more marked changes on both physical and roentgen ray examination than any others in this series.

The Influence of Posture on Digestion in Infancy. **Charles Hendee Smith, M.D., and Leon Theodore LeWald, M.D., New York City. (The American Journal of Obstetrics and Diseases of Women and Children, April, 1915, vol. ix, p. 261.)**

Posture has an important bearing on digestion in infancy. The way in which posture can affect digestion depends on two main factors. The first factor concerns the anatomy of the stomach. Roentgenography has shown the fallacy of the old idea that the stomach in infancy is vertical in position. The second factor is that there is a certain amount of gas in the stomach of every individual. This gas may be derived from three sources, namely, swallowed air, gastric fermentation and intestinal gas.

Gastric fermentation is rare, and is an important source only when there is stagnation from obstructed pylorus or from gastric atony of extreme degree. Intestinal gas does not commonly pass back into the stom-

ach, in all probability. Swallowed air accounts for the gas in the stomach in the large majority of cases.

Usener noted the air-bubble in older children to be smaller than in infants. He stated also that the gas in the stomach has been proved to contain only oxygen, nitrogen and carbon dioxid, or merely the constituents of air. He explained the mechanism of the comparatively large amount of air swallowed by infants as follows: The horizontal position is probably one cause of air-swallowing, as it is in adults in bed with acute illness or after operations, who often have great difficulty in swallowing properly and often swallow air with liquids. In nurslings each small drop of milk on reaching the region where the swallowing reflex is initiated starts the reflex and causes swallowing of air with the milk.

Flesch and Petri, with the fluoroscope, saw an air-bubble appear with the first swallow and fill one-third to one-fourth of the stomach during the feeding in both breast-fed and bottle-fed infants.

Grulee thinks that the gas mostly comes from gastric fermentation due to stagnation from short-interval feeding. If this were true, the air-bubble should be absent when children are fed at long intervals. In our observations such children, however, show gas-bubbles but little smaller than those fed too often. The character of the eructated gas suggests fermentation only in cases of extreme gastric stagnation.

To an infant was given her usual bottle with bismuth, 1:8. She took the first half ounce in about two minutes. Three minutes later the first exposure was made, a lateral view of the child held in the horizontal position. There is a small amount of milk in the stomach with a moderate bubble of gas between it and the anterior abdominal wall. The child was held in the horizontal position and then given one and one-half ounces more of the food in three minutes. The second exposure, taken ten minutes from the beginning of the feeding, showed a very large amount of gas above (ventral to) the milk. The stomach was greatly distended already. The child was crying and was uncomfortable even with half of the feeding in the stomach. The child was then given one and one-half ounces more, but this was taken badly and the last half ounce of the feeding was absolutely refused. About fifteen minutes were spent in trying to get the food down; different nipples were tried, but the child could swallow no more. The third exposure, eighteen minutes after the second, showed why the last half ounce was refused. The enormous gas-bubble plus the milk had so distended the stomach that no more could be taken. This gas must have been swallowed air, since it appeared during the feeding; there was no stagnation of food from the last meal, and the gas appeared too rapidly to be the result of fermentation. The food contained no substance which could form gas with the gastric juice in amount large enough to distend the stomach to this extent. The bismuth subcarbonate used does not evolve gas with hydrochloric acid under 0.5 per cent. This gas-bubble must be composed largely, if not entirely, of swallowed air.

Food taken by a child enters the stomach and gravitates to its lowest part, displacing the gas present to the highest part. The behavior of liquid and gas in the stomach does not differ from that of liquid and gas in a glass bottle or any other receptacle. When the child is held in a horizontal position the liquid food therefore gravitates to the posterior part of the stomach, that is, the fundus end, and forces the gas present to the anterior part of the fundus and to the right end of the stomach. Since the cardiac orifice is situated well back against the vertebral column, it follows that it will be covered by the liquid and that the gas cannot escape into the esophagus. It can escape only through the pylorus, if at all. If the amount of food plus gas is enough to distend the stomach, either food and gas must be forced out through the pylorus, or regurgitation of food must take place through the esophagus until the tension on the stom-

ach wall is relieved. The horizontal position causes a perfect water-lock to form as far as the gas and the cardiac opening are concerned. This may be readily imitated by taking a bottle two-thirds full of liquid. When the bottle is held on its side no air can escape through the bottle mouth. When the bottle is held upright, the gas can escape with ease if under pressure.

When a child is held upright the liquid gravitates at once to the dependent part of the stomach, displacing the gas to the highest part—that is, to the upper part of the fundus—and this makes it possible for the gas to escape by the esophagus. This often takes place at once as soon as the child is held erect.

The horizontal prone position is better than the supine, because the liquid food gravitates to the anterior part of the stomach and forces the gas to the posterior part. This places the cardiac orifice above the level of the fluid, and makes it possible for the gas to escape by the esophagus. This is perhaps the reason why so many infants sleep better "on their stomachs" than on their backs.

If the child is kept horizontal from one feeding to the next, the result depends on how much air is swallowed with the food, the capacity of the stomach and the ease with which the child vomits. If a large amount of air is swallowed, vomiting nearly always takes place, usually in the form of simple regurgitation, but occasionally the vomiting may be violent and projectile. Children vary greatly in the amount of air swallowed and in the degree to which the stomach will bear distention. Some will swallow and retain an enormous air-bubble without vomiting, but the usual result is rejection of part of the food by mouth until the tension on the stomach wall is relieved. The effect on the stomach of the extreme distention seen in some cases must be unfavorable to digestion. It seems as if there must be interference with secretion by the pressure on the mucosa and blood vessels. If the gas is expelled, then the stomach is free to contract and secrete. When the child is *kept* in the horizontal supine position, the gas is gradually forced through the pylorus, and must traverse the intestine before escaping, for even if part of the food is vomited, the gas cannot escape by mouth. If the gas is in large amount, it causes intestinal colic. This symptom may often be entirely relieved by assisting the expulsion of the gas by mouth, so that it need not be passed through the intestine. The symptom of "colic" is probably due in many cases to painful gastric distention, as well as painful intestinal peristalsis. The frequency with which colic accompanies regurgitation is suggestive of their common origin.

Children vary greatly in their ability to relax the cardia and eructate, some doing it easily and apparently voluntarily, while others do it only with great difficulty. The instinctive posture which many mothers assume (if not taught otherwise by nurse or doctor), when they hold the baby up against the shoulder after nursing, is the one in which the baby can most easily get rid of this undesirable swallowed air. Patting on the back aids the process of eructation, and it sometimes requires patting of considerable force. Slight pressure on the epigastrium may be needed, the mother grasping the baby's abdomen with her free hand and gently rubbing and pressing the stomach with her thumb, as he rests against her shoulder. At times the eructation may be violent and the contraction of the stomach so forcible and rapid that a small amount of milk comes up with the air. The amount of regurgitation from this cause is negligible, compared to the comfort given the baby by relieving his gastric distention. The air does not always all come up at once, often requiring several eructations. In some cases a baby has to be held up every two to three minutes during the feeding to prevent vomiting from air swallowing. It is seldom possible to remove all the gas even when the baby eructates easily, but the small remaining amount causes no discomfort, as a rule.

Many very feeble babies vomit whenever put down on their backs, even if held upright until the gas has all been expelled. The cardiac sphincter seems to have no power, and the milk simply flows out of their mouths whenever gravity has a chance to act. This may be stopped, in some cases at least, by constantly keeping the basket or bed at an angle of about forty-five degrees, and never letting the child assume a horizontal position. The prone position may be borne, but it is better to have the head well raised.

The time taken at the bottle or breast is of importance. We believe that it is better for a child to take a feeding too rapidly than too slowly. Rapid nursing may choke the baby and cause coughing, gagging and vomiting if the pharynx fills too rapidly. Slow feeding, that is, twenty to thirty minutes, only multiplies the number of swallowing acts, diminishing the amount of milk and increasing the amount of air taken in each swallow. The old argument against rapid feeding is probably based on cases in which an enormous amount of milk was obtained from very full breasts and regurgitated from *over*feeding, not from *rapid* feeding. If an infant is weighed every minute while nursing a full breast, it is often found that fifty per cent. of the milk is taken in the first two to three minutes, seventy-five per cent. in the first five minutes, and after that the amount per minute decreases rapidly. Such infants show no more signs of discomfort or indigestion and do not vomit more than others, unless they stay at an empty breast sucking and swallowing air. Rapid feeding, therefore, in itself causes no symptoms, and except in the case of feeble infants there is no good reason why a feeding should not be taken in five to ten minutes, or at most in fifteen rather than the traditional twenty.

This is quite contrary to the usual teaching. Nurses are taught that the baby must spend twenty minutes at a bottle. Experience shows that the holes in the nipple must be made very small indeed to prevent a strong child from emptying a bottle in ten minutes. It is much better to have four or five large holes so that the milk runs freely without shaking the bottle when it is inverted, and let the baby regulate the time for himself. Puny infants often become so discouraged at sucking at a nipple with the usual small holes that they will not try to take the bottle at all.

The teaching in practically all training schools for nurses has been that the baby should be kept in the horizontal position after nursing and must on no account be held up, or "moved about." This theory probably had its origin in an effort to counteract the trotting, rocking, jouncing habits of so many mothers—which of course may cause vomiting—the milk being splashed out of the stomach as it would be from a bottle. This does not take place easily, however, unless the child is held horizontally during the trotting or rocking.

Hospital feeding cases are usually examples of the bad results of the horizontal position. In many hospitals the babies are fed in bed and allowed to lie without change of position day in and day out, except when taken up to be bathed or moved to another bed. It is a simple matter to note in practically any case in such a ward that the abdomen is distended, with a large area of gastric tympany. Holding the child erect for a moment will bring up a large bubble of gas, and the percussion note of the epigastrium changes at once. Besides the effect on the stomach, and on regurgitation, etc., it must be bad for such babies to lie in one position all day.

Older children who sit up by themselves regulate this matter under ordinary circumstances, but in acute illness, as pneumonia, there may arise a condition of gastric distention due to the horizontal posture.

Raising such patients to the erect posture occasionally aids in the eructation of gas and relieves the pressure on the heart and lungs. This is probably one reason why surgical patients do better in the semi-erect position than when the foot of the bed was raised, as was formerly the general practice.

Medical textbooks do not mention the posture of the child after or between feedings as a cause of vomiting or indigestion. The matter is dismissed with the general statement that the child should not be moved about after feeding. Medical writers are also silent on this subject with a few exceptions.

Conclusions

Air is swallowed with the food by many, if not by all, infants.

The erect posture favors eructation of this air, the horizontal posture prevents it.

The horizontal posture, by preventing eructation, is an important cause of vomiting, colic, indigestion and disturbed sleep.

The following routine should be followed in feeding every infant: Before feeding, the infant should be held upright to allow the escape of any gas present in the stomach. Immediately after feeding, the infant should be again held up against the shoulder of the mother or nurse. He may be patted on the back, or gentle pressure may be made on the epigastrium to encourage eructation of the swallowed air. It may be necessary to interrupt the feeding one or more times to hold the child upright to eructate, in cases in which an excessive amount of air is swallowed. After the gas is eructated, the child should be put down to sleep, preferably in the prone position and with the head of the bed raised. If restless, he may be taken up after a short time, to see if there is more air in the stomach.

Habitual tongue-suckers need to be held up several times between feedings, as they constantly swallow air. Other suckling habits must be prevented by mechanical restraint.

Feedings should be given at as long intervals as possible, depending on the gastric capacity and the total daily requirements. A feeding should not be taken too slowly. From five to ten minutes are enough, as a rule; fifteen minutes should be the maximum time at bottle or breast.

The importance of posture and the wrong teaching given to physicians and nurses in the past warrant the emphasis laid on so simple a matter.

(This article is illustrated with twenty-three reproductions of roentgenograms made by Dr. LeWald.)

Is Intensive or Long-Continued Irradiation to be Preferred? **(Intensiv- oder Dauerbestrahlung). S. Löwenthal and Pagenstecher. München. med. Wchnschr., 1914, lxi, 187.**

The authors believe that a long treatment with small dose of radium or mesothorium is to be preferred to a short treatment with large doses, because the effects are better. They found that with strong filtration, that is, through lead, and a sufficiently long duration, a satisfactory deep effect could be obtained without injury to the skin. Since the tendency of the tumor to grow is not annihilated during the intervals of treatment, the intervals in the treatment of sarcoma and carcinoma should be as short as possible, and the times of irradiation lengthened and brought nearer together. Carcinoma and sarcoma are especially adapted to this long-continued treatment, which is generally administered with several tubes at the same time, and so far as possible stationary. Brain tumors and actinomycosis are also favorably influenced by the author's method of treatment. An apparatus especially adapted for it is being prepared.

DEPARTMENT OF BOOK REVIEWS

Editor, Edward H. Skinner, M.D., Kansas City, Mo.

Peroral Endoscopy and Laryngeal Surgery. By Chevalier Jackson, M.D., Professor of Laryngology, University of Pittsburgh; Consulting Laryngologist, Bronchoscopist, Esophagoscopist, and Gastroscopist, Western Pennsylvania Hospital; Laryngologist, Presbyterian Hospital; Laryngologist, Eye and Ear Hospital; Consulting Laryngologist, Bronchoscopist, Esophagoscopist and Gastroscopist, Montefiore Hospital; Consulting Laryngologist, Bronchoscopist, Esophagoscopist and Gastroscopist, St. Francis Hospital; Consulting Laryngologist, Bronchoscopist, Esophagoscopist and Gastroscopist, Passavant Hospital; Bronchoscopist and Esophagoscopist, Allegheny General Hospital; Bronchoscopist and Esophagoscopist, Pittsburgh Hospital for Children. With 6 colored plates and 490 illustrations. The Laryngoscope Company, St. Louis, 1915. Price, $5.00.

To the roentgenologist this book is especially recommended. The author's dependence upon roentgenology is noteworthy. He insists upon the roentgen examination as a routine in all cases of foreign bodies and in esophageal pathology. Again, the advantages of fluoroscopic control in successful bronchoscopy are convincingly shown. The author has devised a caliper guide for use with lateral exposures of the chest. He also illustrates a positive film of the bronchial tree, which can be superimposed upon the roentgenogram of a chest, to aid in plotting the location of a foreign body. The book is profusely illustrated with roentgenograms of chests harboring foreign bodies. Roentgenologists will ratify Dr. Jackson's remarks upon "Errors to avoid in suspected foreign body cases," when he says, "Do not fail to have a radiograph made, if possible, whether the foreign body in question is of a kind dense to the ray or not," and "Do not tell the patient he has no foreign body until *radiograph*, physical examination, indirect examination, and endoscopy all have proved negative."

The profession has been awaiting this book for some time. Dr. Chevalier Jackson is so well known for his remarkably capable endoscopic ability that this descriptive publication upon his own methods, instruments and technique will find a welcome reception.

To speak of this book as a complete treatise upon Endoscopy and Laryngeal Surgery is warranted by the fact that the volume of 705 pages is entirely devoted to a text upon the title alone. For instance, the author has refrained from filling or adding pages upon the symptoms and diagnosis, except as they illuminate the peroral endoscopic text.

There are 46 chapters. One notices ample and unusual discussions upon Anesthesia for Peroral Endoscopy, Bronchoscopic Oxygen Insufflation, Acquiring Skill, Unsuccessful Cases of Bronchoscopy, Pleuroscopy, Decannulation After Cure of Chronic Laryngeal Stenosis, Technic of Laryngectomy, etc. These are unusual headings of chapters culled from an array of conventional chapter titles which such a book naturally presents when bronchoscopic, esophagoscopic, gastroscopic and laryngoscopic methods are concerned. In and middle of the book there is a grand illustrated table of hardware, jewelry, ammunition, buttons, pins, safety pins, coins, bones, meat, seeds, nuts, shells, minerals and dental objects to the number of 365, which the author has encountered in the pursuit of this precise specialty. Following this are about 20 roentgenograms of cases illustrating the localization of foreign bodies awaiting endoscopic pursuit.

The book is beautifully printed and the illustrations are all that could be desired. To those who are at all busy with bronchoscopy or esophagoscopy, this book becomes a necessary possession. It will be fascinatingly instructive to every physician by reason of the illuminating text upon this venturesome specialty.

E. H. S.

THE ROENTGEN DIAGNOSIS OF SURGICAL LESIONS OF THE GASTRO-INTESTINAL TRACT. By Ariel W. George, M.D., Assistant Professor of the Department of Roentgenology, Tufts College Medical School; Consulting Roentgenologist to the Carney Hospital, Boston Dispensary and the Forsyth Dental Infirmary; Member of the American Roentgen Ray Society; and, Ralph D. Leonard, A.B., M.D., Assistant in Roentgen Department Boston City Hospital, Instructor in Roentgenology at Tufts College Medical School. 306 pages, including 7 three-color illustrations, 18 artist's drawings, 343 roentgen plate reproductions. The Colonial Medical Press, Boston, 1915. Price, $10.00.

This elaborate volume is another triumph for American roentgenology. One glance through these pages of clear roentgen reproductions and clean precise interpretations will convince any physician that this book is the apogee of successful gastro-intestinal roentgenology. A careful analysis of the book more than corroborates the preliminary notices. The authors have carried out their purpose to demonstrate the possibilities of the roentgen ray in the exact diagnosis of the common surgical lesions of the gastro-intestinal tract.

The contents of the book are divided quite naturally into sections upon: I. Normal Stomach; II. Gastric Ulcer.; III. Gastric New Growth; IV. Duodenum; V. Gall-Bladder; VI. Small Intestine; VII. Appendix; VIII. Large Intestine; IX. Diverticulitis. Under these several headings we find an imposing array of case reports accompanied by brilliantly reproduced roentgenograms. The clearness of these cuts is remarkable and is no doubt due to the primary excellence of the author's negatives and to the high grade paper upon which they are printed. The authors are to be congratulated upon their choice and arrangement of the illustrations. Each illustration carries key letters referring to the descriptions upon the page opposite. These descriptions are laconic to a degree, but the salient facts are not overlooked.

The wealth of illustrations to this book is a noteworthy point. For instance, there are some 35 cuts upon the normal stomach, 45 for gastric ulcer, 38 upon gastric new growth, 60 upon duodenal ulceration, 39 upon gall stones, 47 upon the appendix, 28 upon small intestine, 30 upon large intestine adhesions, 22 upon intestinal new growth and 11 upon diverticulitis. When it is realized that these 369 illustrations are of that many different cases, with one or two exceptions, the reader will be astonished at the experience behind the publication.

At the beginning of each section of this classic there are a few pages of text which are wonderfully illuminating and instructive, even though extraordinarily brief. There is much which can be read between the lines. While such interlinear reading is easy for the roentgenologist who is familiar with the literature upon the subject, there will probably be many statements which will demand a certain degree of faith from the neophytic reader. Such brief text frequently lays the author open to undue criticism, especially in medicine, which hardly sustains as accurate statements as mathematics. Still we must realize that the simplicity and directness of George's diagnostic facts are based upon the exact demonstration of a surgical condition subsequently proved by operation or autopsy.

The style of the text is distinctly Georgian. To this there can be no exception. There is a buoyancy and enthusiasm displayed in the printed words that will be reflected in the reader. If this style was injected into a modern novel it would become a best-seller. There are many sentences which present themselves for comment. In fact, many of George's statements seem to stand out fully armed inviting attack. For instance, "We claim with our meal of buttermilk and barium that, in every instance, unless the lumen be obliterated, the appendix will fill and it will remain so long enough to be demonstrated on the roentgen plate or roentgenoscope. To this statement we believe there is no exception." Rarely in seasoned medical writing are such bold statements possible. But such forceful diction is comforting to the roentgenologist. If the medical profession as a whole could be forced to acknowledge the value of the roentgen ray as George so convincingly states the facts there would be no dust upon the serial roentgen tables of America.

It always remains for one or two men to

stand out and defend a new method or a revolutionary fact. There is much more glory to one who defends than to one who defies. Let us hope that the medical profession will look upon Doctors George and Leonard as defenders of the faith that roentgenologists have in their works. Surely this splendid volume will meet with the wide distribution it deserves. As an atlas for daily consultation it will be welcomed by roentgenologists and as an example of efficient roentgenology it will be sought by the profession generally. It is a triumph of American roentgenology. E. H. S.

RADIUM X RAYS AND THE LIVING CELL. By Hector A. Colwell, M.B. (Lord), D.P.H. (Oxford), and Sidney Russ, D.Sc. (Lord). Price $4.00.

This book marks another epochal effort in the therapeutic use of radiant energy. The construction of a rational basis of radiotherapy depending upon the tissue absorption of rays of different wave lengths is briefly the theme of this book. The authors describe some of the main experimental facts which have been established. To those who are seriously interested in such experimental investigation this book will serve as a splendid guide. To those who are daily applying radium and the roentgen ray in practice this book will open up new fields of thought and increase the efficiency of their work.

Part I, comprising 86 pages and 13 illustrations, provides scientific information upon the physics of radiant energy as displayed in radium, the roentgen ray, etc. The bibliographic references are quite complete and the frequent tables are illuminating. The comparisons between the types of radiant energy are the result of much original research and become remarkably instructive.

Part II, of over 200 pages and 50 illustrations, two of which are colored plates, takes up the chemical, biologic, physiologic and differential effect of radiant energy upon animal life, plants, bacteria, the various human tissues, malignant cells, etc.

There is a splendid chapter upon Idiosyncrasy and Dosage of peculiar interest. The author states that "there is little reason to doubt that an idiosyncrasy actually exists in the sense that the same dose of radiation will provoke a reaction, the degree of which varies with the individual. A surface whose blood supply is temporarily impoverished is observed to react to a much smaller degree than when measures are taken to induce a liberal flow of blood to the part; it seems not unreasonable to associate such an effect with the secondary radiation, which would undoubtedly be emitted by the iron in the circulating blood. Apart from the question of idiosyncrasy, however, there must come a stage at which the equivalence of a large dose acting for a short time and a small dose acting for a long time, must be lost. . . . The terms soft, medium and hard distinguish, in a comparatively rough manner, various types of radiation, but with the added exactness which the determination of wave-length of *x*-rays has conferred, it is likely and desirable enough that such terms will either be quite accurately specified as extending over certain regions of the spectrum, or be replaced by the numerical values of the wave-lengths of any radiation in question. This is but one aspect of *x*-ray dosage, and a large amount of clinical and other experimental evidence has accumulated to show that no simple quantitative relation exists between the reaction of the living cell, or system of cells forming a complex organism, and the amount of radiation incident upon it; hence, wherever possible, all the factors concerned in the administration of the rays might with advantage be specified."

The author promotes a happy invention when he discards the term "selective action" in favor of "differential action." "To some it (selective action) has appeared to focus too much attention upon the rays and too little upon the thing irradiated. This response, on the part of any particular type of cell, is in fact dependent upon the kind of rays to which it is subjected; in other words, different rays give rise to quite different effects upon one and the same variety of cell; they have in fact a 'differential' action, and a careful distinction should be made between the differential action which different rays have upon the same variety of cell, and the selective action which the same kind of radiation has upon the many different varieties of cells."

To the roentgen therapist this book will be especially welcome for the original experimentation and the studied survey of previous work in the application of radiant energy. The imminent universal demand for roentgen treatment of malignancy makes this book eminently authoritative and useful as a guide. E. H. S.